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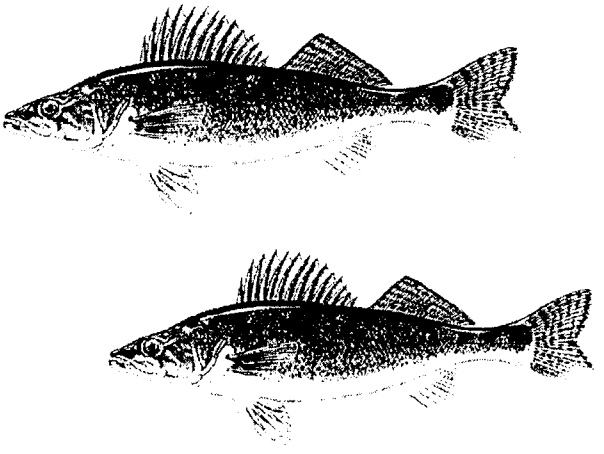
FAS-LAKES for Paradox
Version 2.1



Illinois Department of Natural Resources
Division of Fisheries

December 1996

FAS - LAKES USERS MANUAL
Version 2.1
(December 1996)

Illinois Department of Natural Resources - Division of Fisheries
Illinois Natural History Survey

Acknowledgments

FAS-LAKES for Paradox is the culmination of an endeavor, which began in 1984, to provide IDNR fisheries managers with a comprehensive system for managing and analyzing standard fish population survey data. The initial Apple //e - based version of this system and the current DOS-based system for PCS were developed at the Illinois Natural History Survey as part of an ongoing project with the Illinois Dept. of Natural Resources-Division of Fisheries entitled "Database Management and Analysis of Fisheries in Illinois Lakes: Optimizing Fisheries Management." Support for this project has been provided by the Federal Aid in Sport Fish Restoration fund of the U.S. Fish and Wildlife Service (Federal aid projects F-46-R and F-69-R).

In particular, the creation and development of this system are due to the efforts of Dr. Peter Bayley of Oregon State University, who served as INHS principal investigator from the project's inception through 1994, and, especially, Robert Illyes, the project's principal programmer, whose talents lead to the development of all aspects of this package. Completion of this database and analysis package would have also been impossible without the input, support, and great patience provided by Division of Fisheries project and field managers and chief staff. We hope you'll find this manual and package well worth the wait.

Fisheries Analysis Section
IDNR-Division of Fisheries

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INTRODUCTION

The 1996 Version 2.1 release of the Fisheries Analysis System (FAS) suite of programs is a totally redesigned software package for computers with Intel-based processors and utilizing the Paradox database management system. This software provides many of the same features of the old Apple //e system, but is significantly faster and easier to use. The following manual gives step-by-step instructions for installing the software on the PC, entering data into the FAS, and creating tabular and graphical outputs.

Database Design

The new database consists of eight tables, one less than in the old General Manager database system. Listed below are the tables showing the order of the fields, the field name and the type of field (N=numeric, A=alphanumeric, S=short integer, D=Date). **Understanding the organization of information in the database will be important** for proper operation of the FAS and will allow you greater flexibility and power for developing your own methods for analyzing data.

Screen 1 - District Information (one record per district manager)

Field	Field Name	Field Type	Description
1	REGION	S	IDNR Fisheries Region number
2	DISTRICT	S	IDNR Fisheries District number
3	DISTBIOL	A21	Name of current district fisheries manager
4	REPLNAME	A21	Name of previous district manager
5	REPLDATE	D	Date the current manager started
6	YRDATAST	S	First year of district data within FAS
7	YRDATATO	S	Most recent year of district data within FAS
8	DDSCALE	A2	(M)etric or (E)nglish units used for depth and distance measures in historic (Apple //e) data
9	COMMENT1	A70	Comments pertaining to the district

Screen 2 - Lake/Station Specific Information (one record per season for each lake station sampled)

Field	Field Name	Field Type	Description
1	LAKE	A30	Standard lake name (see Waters table)
2	SEASON	A2	2-character Season/Trip code
3	STATION	A1	1-digit station number
4	COUNTY	A3	3-digit county code
5	ACREAGE	N	Surface area of lake (acres)
6	CLASS	A2	2-character IDNR lake class code
7	MAXDEPTH	N	Maximum depth of lake (ft)
8	AVGDEPTH	N	Average depth of lake (ft)
9	SHORELT	N	Shoreline length of lake (ft)
10	COMMENT2	A70	Comments regarding lake
11	LOCATION	A70	Location of station
12	STSHRLT	N	Station shoreline length (ft)
13	ZCOMMENT	A31	Comments regarding the lake station

Screen 3 - Standard sample information (one record per lake station/season/sample combination)

Field	Field Name	Field Type	Description
1	LAKE	A30	*see Screen 2 description*
2	SEASON	A2	*see Screen 2 description*
3	STATION	A1	*see Screen 2 description*
4	SAMPLE	A2	Sample code (gear code + run number)
5	LOCATION	A70	Location of sample area in the lake
6	SHORELEN	N	Length of shoreline sampled (ft)
7	XDISOFF1	S	Average distance (ft) from shore at 5 ft depth
8	XDISOFF2	S	Average distance (ft) from shore at 10 ft depth
9	HARDCOV	S	Hard cover rating (0-3; none to extensive)
10	PCTRIPRAP	S	Percentage of sampling zone shoreline covered by rip-rap
11	COMMENT3	A70	Comments pertaining to where and how the sample is typically collected

Screen 4 - Information specific to station (one record per lake, date, and station)

Field	Field Name	Field Type	Description
1	ID	A13*	Sample ID (unique to lake-year-season-station combination)
2	LAKE	A30	*see Screen 2 description*
3	SEASON	A2	*see Screen 2 description*
4	STATION	A1	*see Screen 2 description*
5	YEAR	S	4-digit calendar year
6	MONTH	S	
7	DAY	S	
8	RECDTIME	S	Time of water chemistry measurement (military time with no colon between hr- min)
9	AIRTEMP	N	Air temperature (°C)
10	TOTALK	N	Total alkalinity (mg/l)
11	CONDUCT	S	Conductivity (µmhos)
12	SECCHI	N	Secchi disk depth (ft)
13	H20LVL	N	Water level relative to normal pool (ft)
14	BOATMAN	A12	Name of boat operator
15	FDIPPER	A12	Name of front dipper
16	COMMENT4	A31	Comments related to sampling at that lake station on that specific date

* - indicates a Paradox key field. All records will be sorted in ascending order based on the value of this field or combination of fields.

Screen 5 - Depth profile of temperature/DO/pH at a station (one record per depth measurement)

Field	Field Name	Field Type	Description
1	ID	A13*	*see Screen 4 description*
2	DEPTHFT	N*	Measurement depth (ft)
3	H20TEMPC	N	Water temperature (°C)
4	O2PPM	N	Dissolved oxygen (ppm)
5	PH	N	pH

Screen 6 - Sample run information (one record per gear and run or set)

Field	Field Name	Field Type	Description
1	ID	A13*	*see Screen 4 description*
2	SAMPLE	A2*	*see Screen 4 description*
3	MONTH FISHED	S	Month sample was collected
4	DAY FISHED	S	Day sample was collected
5	START	S	Start of sample run (military time, no colon)
6	END	S	End of sample run (military time, no colon)
7	GEAR24H	A1	Y/N, noting if net was set for > 24 hours
8	PCTSHORE	S	Percentage of shoreline sampled
9	WEEDCOV	S	Surface weed cover percentage in sampled area
10	PCTSHAD	S	% of total runtime if shad were subsampled
11	MAXTLSHAD	S	Max. total length of subsampled shad (cm)
12	FASSP2	A3	Species code for subsampled fish/group #2
13	PCTSS2	S	% runtime sampling FASSP2
14	MAXTLSP2	S	Max. total length (cm) of fish in subsample #2
15	FASSP3	A3	Species code for subsampled fish/group #3
16	PCTSS3	S	% runtime sampling FASSP3
17	MAXTLSP3	S	Max. total length of fish in subsample #3
18	FASSP4	A3	Species code for subsampled fish/group #4
19	PCTSS4	S	% runtime sampling FASSP4
20	MAXTLSP4	S	Max. total length of fish in subsample #4
21	COMMENT6	A70	Comments regarding sample and subsampling

Screen 7- Fish length frequency (one record per sample-species-centimeter interval)

Field	Field Name	Field Type	Description
1	ID	A13*	*see Screen 4 description*
2	SAMPLE	A2*	*see Screen 4 description*
3	FASSP	A3*	FAS fish species code
4	TLCM	S*	Centimeter length group, given in the equivalent millimeter value (e.g., 120 for fish within the 12cm length interval)
5	FREQ	S	Number of fish collected, falling within the centimeter interval, TLCM .

Screen 8 - Individual fish data (one record per fish measured)

Field	Field Name	Field Type	Description
1	ID	A13*	*see Screen 4 description*
2	SAMPLE	A2*	*see Screen 4 description*
3	FASSP	A3*	*see Screen 7 description*
4	SEQ	S*	Fish sequence number. Value is assigned automatically. Used as part of key for Screen 8.
5	TLMM	S*	Total length (mm)
6	WTG	N*	Weight (gm)
7	ENVCODE	S	Envelope code for scale or otolith
8	AGES	S	Scale age
9	AGEO	S	Otolith age

ILCOUNTY - County information

Field	Field Name	Field Type	Description
1	COUNTY	A3	3-digit IL county code
2	CONAME	A11	County name
3	IDNR-REGION	S	IDNR Fisheries Region number
4	IDNR-DISTRICT	S	IDNR Fisheries District number

GEAR - Gear codes

Field	Field Name	Field Type	Description
1	GEARTYPE	A1	One-letter gear designation code
2	GEAR	A40	Description of gear type

Gear Codes in table **Gear**:

Gear Code	Description
A	Draining
B	Basket trap
C	Cove rotenone
D	Drag seine
E	Electrofishing (AC boat-mounted)
F	Fyke net
G	Gill net (125-ft. standard, experimental five panel, 0.5 - 2.5 in. mesh)
H	Hoop net
I	Trap net (1-inch bar mesh)
K	Backpack shocker (Smith-Root VII, pulsed DC)
L	Gillnet, 250 - ft. (twice repeating 125 - ft. experimental nets)
M	Minnow seine
N	Night electrofishing (AC boat-mounted)
O	Otter trawl
P	Primacord
R	Trammel net
S	DC boat electrofishing
T	Trap net (0.5-inch bar mesh)
W	30-foot electric seine
X	Supplementary AC boat electrofishing

SEASON - Explanation of season codes (one record per season/trip combination)

Field	Field Name	Field Type	Description
1	SEASON	A2	Season code
2	SEASTXT	A	Name of season

Records in table **SEASON**:

11	SPRING - Trip #1	31	FALL - Trip #1
12	SPRING - Trip #2	32	FALL - Trip #2
13	SPRING - Trip #3	33	FALL - Trip #3
21	SUMMER - Trip #1	41	WINTER - Trip #1
22	SUMMER - Trip #2	42	WINTER - Trip #2
23	SUMMER - Trip #3	43	WINTER - Trip #3

WATERS - Water names, numbers and descriptive information (one record per water body).

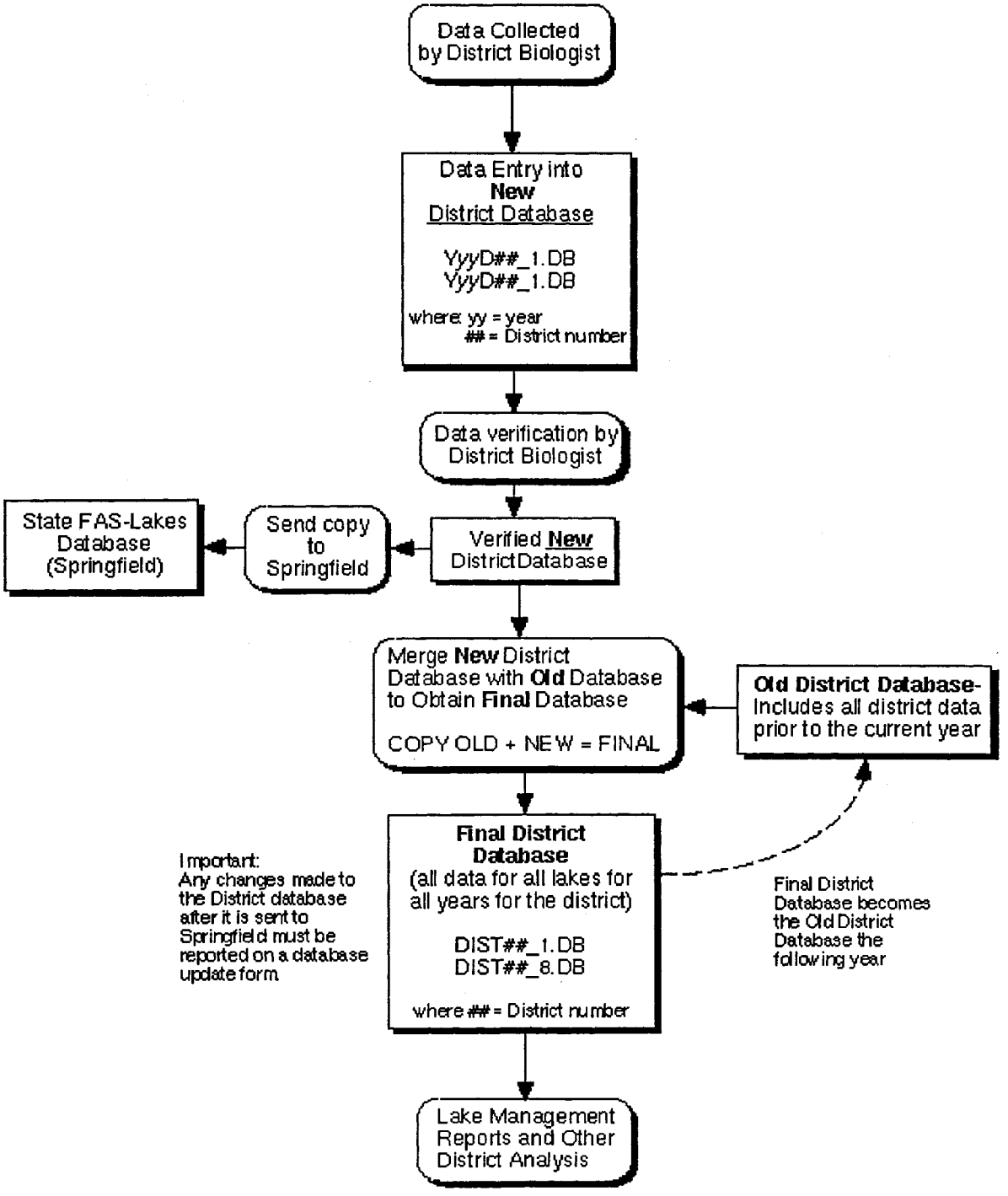
Field	Field Name	Field Type	Description
1	WATERNUM	N	5-digit IDNR water number
2	WATERNAME	A30	Water body name
3	DISTRICT	S	IDNR Fisheries District number
4	REGION	S	IDNR Fisheries Region number
5	COUNTY	A12	County name
6	YEARADDED	S	Year water record was added to the database
7	CLASS	A4	Class (Public, State, Private, Reservoir, etc.)
8	ACREAGE	N	Surface area (acres)
9	TOWNSHIP	A3	Public land survey location description
10	RANGE	A3	Public land survey location description
11	SECTION	A4	Public land survey location description
12	DIRECT	A72	Directions to water body
13	CO_OP	A1	Yes/No cooperative agreement with IDNR
14	OWNERNAME	A26	Owner's name
15	OWNERADDRESS	A26	Owner's address
16	CONTACTNAME	A26	Contact name for the water body
17	CONTACTADDRESS	A26	Street address of contact person
18	CONTACTCITY	A17	City of contact person
19	CONTACTSTATE	A2	State of contact person
20	CONTACTZIP	A10	Zip code of contact person
21	CONTACTPHONE	A13	Telephone number of contact person

SPECIES - Illinois fish species list

Field	Field Name	Field Type	Description
1	FASSP	A3*	3-letter FAS species code
2	COMMON	A45	Fish common name
3	SPECIES	A70	Fish scientific name
4	FAMILY	A15	Family taxonomic name
5	STATUS	A1	Flags if species is federally endangered (F), state endangered (E), or state threatened (T)
6	MAXTLMM	S	Typical maximum total length (mm) of species
7	ILRECWTG	N	Illinois record weight (grams)
8	WRECWTG	N	World record weight (grams)
9	C/M	A1	Flags whether Screen7 lengths are in (C)m or (M)m
10	KNA	N	"a" parameter used in calculating Kn
11	KNB	N	"b" parameter used in calculating Kn
12	WRA	N	"a" parameter used in calculating Wr
13	WRB	N	"b" parameter used in calculating Wr
14	WR_MIN_TL	S	Minimum length (cm) recommended for Wr calculation
15	STOCK	S	Minimum Stock size (cm) for PSD calculations
16	QUALITY	S	Minimum Quality size (cm) for PSD calculations
17	PREFERRED	S	Minimum Preferred size (cm) for RSD calculations
18	MEMORABLE	S	Minimum Memorable size (cm) for RSD calculations
19	TROPHY	S	Minimum Trophy size (cm) for RSD calculations

Data flow

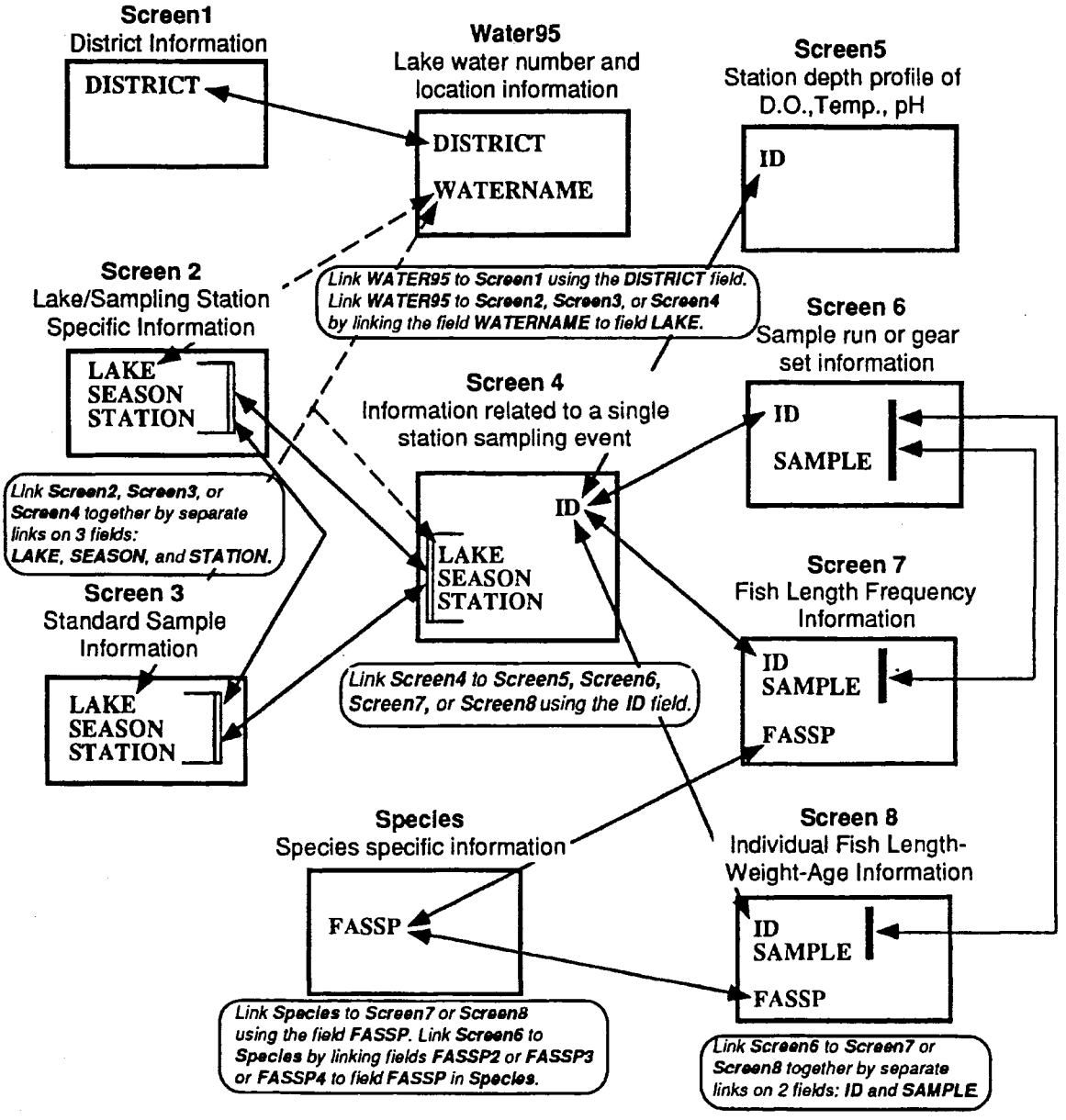
The flow of data from collection in the field to analysis and incorporation into the statewide database is illustrated below:



Linking FAS-Lakes tables

Linking FAS-LAKES Database Tables together within a Paradox Query

Fields that must be linked in order to link (relate) information of different tables together.
(Tables are linked within the ASK option *of Paradox by placing identical example elements, using the F5 key, within each respective linking field of each table.)*



Key points to keep in mind regarding data entry are that you essentially maintain two separate databases for your sample trip data: (1) one for your current year of data collection and (2) a distinct separate database for all of your historical data. The historical database will include all data previously collected in your district that was entered in the FAS. This will be given to you the first time you set up your system. Both databases incorporate the same set of tables for static data (Screen_1, Screen_2, Screen_3, Waters, County, Season, Species, and Gear). Upon completion of data entry and verification your current year data set can be merged with the historical database. Thus, you will have an up-to-date data set of all data collected in your district in one database on the hard disk drive of your computer. A copy of your current data set is also sent to Springfield for incorporation into the statewide FAS database.

Important note: Any changes made to your database, after you have sent a copy to Springfield, must be noted and sent to Springfield so that these corrections can also be made to the statewide FAS database.

PROGRAM INSTALLATION PROCEDURE

The following set of instructions assumes your hard drive is formatted as a single partition (namely C:). If you have more than one partition (ex. C: and D:), first check to see which drive has the most free space available by typing the DOS command 'DIR' from each drive. The drive with the most available space should be made the target drive for installing the FAS software. If more free disk space is available in drive D:, then substitute D: for C: in the following instructions:

1. If necessary, create a directory for the FAS software at the root level of the C: drive named NEWFAS. To create C:\NEWFAS :

   ▸Move to the root level of the C:\ drive by typing:

   CD C: and press the <**Enter**> key.

   The DOS prompt should change to "**C:\>**"

   ▸Next type:

   MKDIR NEWFAS and press the <**Enter**> key.

2. Change to the NEWFAS directory by typing in the following command at the C:\> prompt:

   CD NEWFAS <Enter>

   The prompt should now appear as: "**C:\NEWFAS>**"

3. Place the FAS program installation diskette into the 3.5" disk drive (generally designated as Drive A on newer PCS) and type in the following command:

   COPY A:*.* C: <Enter>

*(Note: Your 3.5" drive may be designated as drive B, if you also have a 5.25" drive on your machine. This is often true with older Dell 316SX computers. If so, substitute **B:** for A: in the above command.)*

This copies the contents of the installation disk to the NEWFAS directory on drive C: . There should now be a single file in the C:\NEWFAS> directory, **LAKE.EXE**. You can verify this by typing in the following command at the C:\NEWFAS> prompt and pressing the <**Enter**> key:

DIR

4. **LAKE.EXE**, is a self-extracting, compressed file containing all of the files that make up the FAS-LAKES package. Before it can be used, it has to be decompressed. To decompress the file, simply type the name of the file (LAKE) at the C:\NEWFAS> prompt and press the <**Enter**> key. Once the decompression process is complete, invoking the **DIR** command will reveal a number of files in the C:\NEWFAS directory.

5. The next step in installing the Lake Enter program is to confirm that the Paradox 4.0 or 4.5 program is referenced in the PATH or SET PATH command line(s) of the AUTOEXEC.BAT file. To view the contents of this file, type in the following command and press the <**Enter**> key:

TYPE C:\AUTOEXEC.BAT | MORE

*(Note: '|' is obtained by holding the <**Shift**> key and pressing <\>)*:

The PATH command line should look something like the following example:

PATH C:\;C:\DOS;C:\WINDOWS;C:\NU;C:\PKWARE;C:\PDOX45

If a "PDOX40" or "PDOX45" entry appears anywhere in this line, no further action is necessary and one can proceed to Step 8. If there is no reference to the Paradox for DOS program directory ("PDOX40" or "PDOX45"), proceed with Step 6. If your AUTOEXEC.BAT file exceeds one page in length, press the <**Enter**> key to display the remainder of the file before proceeding to the next step.

6. The DOS text editor can be used to edit the PATH statement of the AUTOEXEC.BAT file as follows:

(**A**) From the C:\NEWFAS> prompt, type:
EDIT C:\AUTOEXEC.BAT and press <**Enter**>.

(**B**) Once the contents of the AUTOEXEC.BAT file appear on the screen, use the <↑> and < ↓ > keys to scroll the cursor to the SET PATH line. Press the <**End**> key to position the cursor to the very end of this line.

(**C**) With the cursor at the end of the SET PATH line, type in the following:
;C:\PDOX45 (if running Paradox 4.5)
or
;C:\PDOX40 (if running Paradox 4.0)

If Paradox has been installed on a different hard drive partition, such as **D:**, substitute "**C:**" with the appropriate partition letter.

(**D**) To save this change to the file, use the mouse to click on the *File* menu item at the top left of the screen and then click on the *Save* option in the resulting drop down submenu (If the mouse is not functional in the DOS editor, press the <**Alt**> and <**F**> keys simultaneously to access the drop down submenu; then press the <**S**> key to save the file). Exit the text editor by once again clicking on the *File* menu, then clicking on the *Exit* submenu option (<**Alt**><**F**> followed by <**X**> if using the keyboard).

7. Despite having saved the change to the AUTOEXC.BAT file in the preceding step, you will next need to reboot your computer in order for this change to be recognized by the operating system. To reboot the computer, simultaneously press and hold down the <**Ctrl**>, <**Alt**>, and <**Delete**> keys for a second. Alternatively, the computer can be turned off and then, after waiting about 10 seconds, turned back on. The reset button can also be used on PCs so equipped.

8. In order to invoke the Lake Enter program from DOS:
   - If not already there, change directories to the NEWFAS directory (from C:\> prompt, type: **CD NEWFAS** <**Enter**> as was done in step 2).
   - Next, type <**P**> and press <**Enter**> at the C:\NEWFAS\> prompt.

   The Lake Enter program will then begin by displaying a menu box for selecting the database with which you wish to work.

FAS - LAKES DATA ENTRY PROGRAM

Data entry requires that the user follow a set procedure of defining the characteristics of the sample for which the data are being entered. Thus, you must specify a lake, year, station, and sample. You must also enter sample description information such as date, time, effort, and relevant aspects of subsampling or comments on the efficiency or special aspects of the sample. The order for defining the sample is as follows:

1. Select a lake
2. Specify a year
3. Select the month of the sampling trip, the number of the trip for that season, and the number of the lake station
4. Enter data on station water quality, depth profile, and information on each sample run or net set made at that station
5. Select an individual sample (e.g., electroshocking run or net set)
6. Select an individual fish species
7. Enter length-frequency data for that species
8. Enter length-weight-age data
9. Repeat Steps 5 - 9 until all fish data are entered for the specified station
10. Enter or select a new station and repeat steps 4 - 9 until all fish data have been entered for that trip to the lake.

In order to start the program, go to the C:\NEWFAS directory and type in <**P**>. The following menu appears:

```
Illinois Statewide Lake Fishes Database

L      Select lake
Y      Select year
S      Select sample
SP     Select species
SL     Species list

N      Enter station, depth, and gear data for a new sample
LF     Enter length-frequency data
LWA    Enter length-weight-age data

F      Generate a FISHTAB input file.
G      Graph selected data
P      Paradox menu
HELP   View further instructions.
BYE    Leave Paradox

Type in your selection and press Enter:
```

Lake Selection

In order to enter sampling data from field sheets, you first need to select a lake. Do this by typing <**L**> and pressing <**Enter**> at the prompt: **Type in your selection and press Enter:** (*Note: that the program is not case-sensitive. You may enter the letter of any menu option in upper or lowercase letters*). A prompt will follow asking for the lake name.

At this point, you can proceed in one of two ways. First, you can simply type in the name of the desired lake and press <**Enter**>. If the desired lake is in the WATERS table and the name has been typed in as it appears in the table, your entry will appear to the right of the *Select lake* item in the menu, along with its district and region information. This is demonstrated below for a sample set of Glen Shoals Lake data:

```
Illinois Statewide Lake Fishes Database


L     Select lake   GLEN SHOALS LAKE, district 20 in region 4
Y     Select year
S     Select sample
SP    Select species
SL    Species list

N     Enter station, depth, and gear data for a new sample
LF    Enter length-frequency data
LWA   Enter length-weight-age data

F     Generate a FISHTAB input file.
G     Graph selected data
P     Paradox menu
HELP  View further instructions.
BYE   Leave Paradox

Type in your selection and press Enter:
```

The second option for selecting a lake is to press the <**Enter**> key without typing the name of the lake. This will open the WATERS table, which lists all Illinois lakes that have been assigned IDNR water numbers. This listing will also appear if you enter a lake name that fails to have an exact match within the WATERS table.

To select a lake from this table, first position the cursor (an underscore line) anywhere within the record for the desired lake. This may be done in one of two ways. You may use the arrow keys to scroll through the lake listing until the cursor is positioned within the appropriate record. Pressing the <**Esc**> key will then select that lake name and return you to the Lake Enter main menu.

Alternatively, you can invoke the Paradox search utility (ZOOM) to position the cursor to the

desired lake record. To use the Paradox search utility, first, if necessary, position the cursor into the column to be searched, the LAKE column in this example, using the mouse or < → > and < ← > keys. The search utility is then invoked by simultaneously pressing the <**Ctrl**> and <**Z**> keys. A zoom window will appear, in which you type the string of characters that you wish to search for. For lake selections, type the first few letters of the desired lake preceded and followed by two periods (..) . The double period is used as a wildcard by Paradox and represents any string of characters that either precedes or follow the text that you've entered. For Glen Shoals Lake, for example, you would type in **..glen..** and press <**Enter**>. If the desired lake name is Lake Sangchris, one would type in **..sang..** and press <**Enter**>.

<**Ctrl**><**Z**> will position the cursor to the first lake record that matches the search string that you have just entered. If there is more than one lake in the database that matches your search criteria, your first match may not be the record that you require. Position the cursor to the next matching record by pressing the <**Alt**> and <**Z**> keys simultaneously. Continue pressing <**Alt**> <**Z**> until the cursor is positioned on the desired lake record. Then press the <**Esc**> key to select that lake name and get back to the main menu of the Lake Enter program.

If the desired lake is not in the Waters table, a record for it must be added to the table before proceeding with data entry for that lake. The following procedure describes how to edit the Paradox table containing the lake name information.

Adding new records to the Waters table

From the Lake Enter main menu, select the Paradox menu option by typing in <**P**> at the prompt and pressing the <**Enter**> key. This starts Paradox, which will open with all ten database tables used by the Lake Enter program open in the Paradox desktop. If any lake is selected when Paradox menu option is invoked, Paradox starts with Waters (Water95) table active on the desktop. This is the table that contains all the lakes and associated districts, regions and water numbers in the database. This is the table where the new lake information needs to be entered. If no lake is selected when Paradox menu option is invoked, Paradox starts with all ten tables tiled on the screen, with Species table being active. One can get to the Water95 table by pressing the <**F3**> key once. Note that <**F3**> and <**F4**> keys are used when in Paradox to scroll through all the open tables on the desktop. Further note that when more than one table is open on the desktop, the table on top is the active table, i.e., the one that will be the subject of all the commands being issued.

Once the Water95 table appears on the screen, be sure the blinking cursor is in the LAKE column and press the <**F9**> key to enter the Paradox Edit mode. A white arrow head will appear on the right margin of the water name column confirming that one is now in edit mode. Press the <**Insert**> key to insert a blank record above the one where the cursor is located. Note that the cursor automatically moves up to the blank row. First, using the left arrow key or mouse, move the cursor to the WITHERNAM column and enter the lake's five-digit IDNR water number. A water number is required for Lake Enter to store sampling information in the database. Pressing <**Enter**> positions the cursor to the next column to the right, WATERNAME. Type in the name

of the lake and press <**Enter**>. This moves the cursor to the next column, REGION. Type in the region number and press <**Enter**> once again to proceed to the next column. After DISTRICT and WATER NUMBER have been typed in, press the <**F2**> key to save the new information and end the edit session. The white arrow at the right of the column being edited disappears. Note that this procedure can be used to edit information in any of the Paradox tables.

To return to the Lake Enter program, one must first exit Paradox and return to DOS. Restart the program by typing in <**P**> at the C:\NEWFAS> prompt as before. If your mouse is functional in Paradox, terminate the program by clicking on the **Exit** option in the upper right hand of the screen, then click on the **Yes** option in the resulting drop down menu. If the mouse is unavailable, exit Paradox by pressing the <**F10**> key, which activates the menu bar at the top of the screen, and then pressing the <**E**> and <**Y**> keys.

Year Selection

Once a lake has been selected, the next step in the data entry procedure is to select a year. This is accomplished by typing <**Y**> at the prompt: **Type in your selection and press Enter:**. When <**Enter**> is pressed, a new prompt appears: **What is the year?** . Enter the year of the sampling trip and press the <**Enter**> key. Note that the year may be entered as either a four or two digit number, i.e., 1992 or 92. Once the year is entered, the main menu screen displays your entry beside the **Select year** line as shown below:

```
Illinois Statewide Lake Fishes Database

L     Select lake   GLEN SHOALS LAKE, district 20 in region 4
Y     Select year   1992
S     Select sample
SP    Select species
SL    Species list

N     Enter station, depth, and gear data for a new sample
LF    Enter length-frequency data
LWA   Enter length-weight-age data

F     Generate a FISHTAB input file.
G     Graph selected data
P     Paradox menu
HELP  View further instructions.
BYE   Leave Paradox

Type in your selection and press Enter:
```

Station and Gear Entry or Selection

The next step in the data entry process is to enter the station and gear information. Type in <**N**> at the selection prompt and press <**Enter**>. A window displaying months of the year appears. Use the cursor keys to scroll to the desired month and press <**Esc**>.

An "**Enter the trip number:** 1" prompt appears next. Note that trip number '1' is presented as default. If this is correct, accept the default value by pressing <**Enter**>, otherwise press the <**Backspace**> key, type in the correct number and press <**Enter**>.

This brings up the "**Enter the station number:** 1" prompt. Once again, if the default value of '1' is acceptable, select it by pressing <**Enter**>. If not, press the <**Backspace**> key to the delete the default value, then enter the desired number. The appearance of the main menu screen with lake, year, trip, and station selections is shown below:

```
Illinois Statewide Lake Fishes Database

L       Select lake   GLEN SHOALS LAKE, district 20 in region 4
Y       Select year   1992
S       Select sample
SP      Select species
SL      Species list

N       Enter station, depth, and gear data for a new sample
LF      Enter length-frequency data
LWA     Enter length-weight-age data

F       Generate a FISHTAB input file.
G       Graph selected data
P       Paradox menu
HELP    View further instructions.
BYE     Leave Paradox

Type in your selection and press Enter: n
Enter the trip number: 1
Enter the station number: 1
```

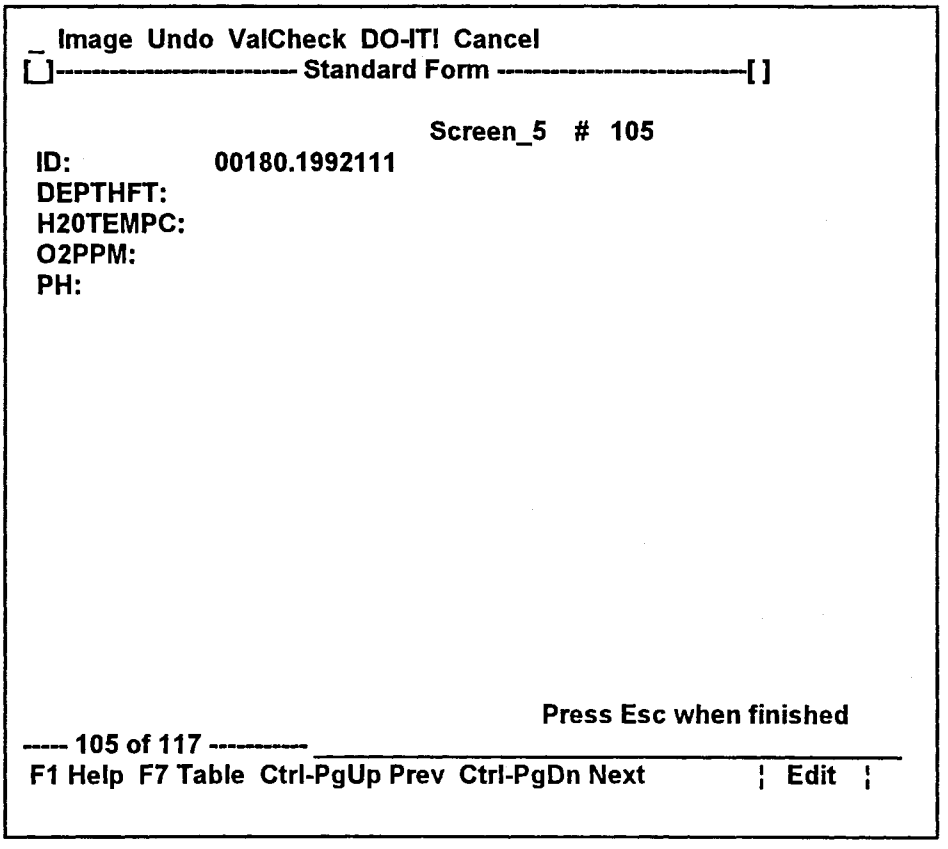
After the station number is entered, press <**Enter**>. This opens a Paradox Screen_4 form with the current selections (lake, season, trip, station, year and month) already filled in, as shown below. Note that there is one additional item present on this form - the ID number. It is generated automatically by the Lake Enter program. In the present example, the ID number is 00180.1992111. This number consists of the water number for the selected lake (00180), the year the data was collected (1992), the sampling season (1 = spring, since this hypothetical data set was collected in April), the trip number (1) and the station number (1). ***It is IMPERATIVE that this number is not changed by the user since all the length/frequency and length/weight data related to the selected parameters is associated with this number.***

```
_ Image Undo ValCheck DO-IT! Cancel
---------- Standard Form ----------

                          Screen_4  #  70
ID:          00180.1992111
LAKE:        GLEN SHOALS LAKE
SEASON:      11
STATION:     1
YEAR:          1992
MONTH:            4
DAY:
RECDTIME:
AIRTEMP:
TOTALK:
CONDUCT:
SECCHI:
H20LVL:
BOATMAN:
FDIPPER:
COMMENT4:

                                                    Press Esc when finished
------ 70 of 86 ----------
F1 Help F7 Table  Ctrl-PgUp Prev  Ctrl-PgDn Next          ¦ Edit  ¦
```

Proceed by filling in values for the remaining pertinent items in the form above. After typing in an item value, for example DAY, press <**Enter**> to move the cursor to the next field - RECDTIME. After all desired data are entered, press the <**Esc**> key. Pressing the <**Esc**> key saves the record to the Screen_4 table. The data entry process automatically proceeds to the **Enter depth profiles now (Y/N)?** prompt for entering data to the Screen_5 table.

Depth Profile Data Entry

Type <**Y**> for yes and press <**Enter**> to access the Paradox form for Screen_5, depth profile data, shown below. Note that the ID number on this form is the same as the one on Screen_4 form.

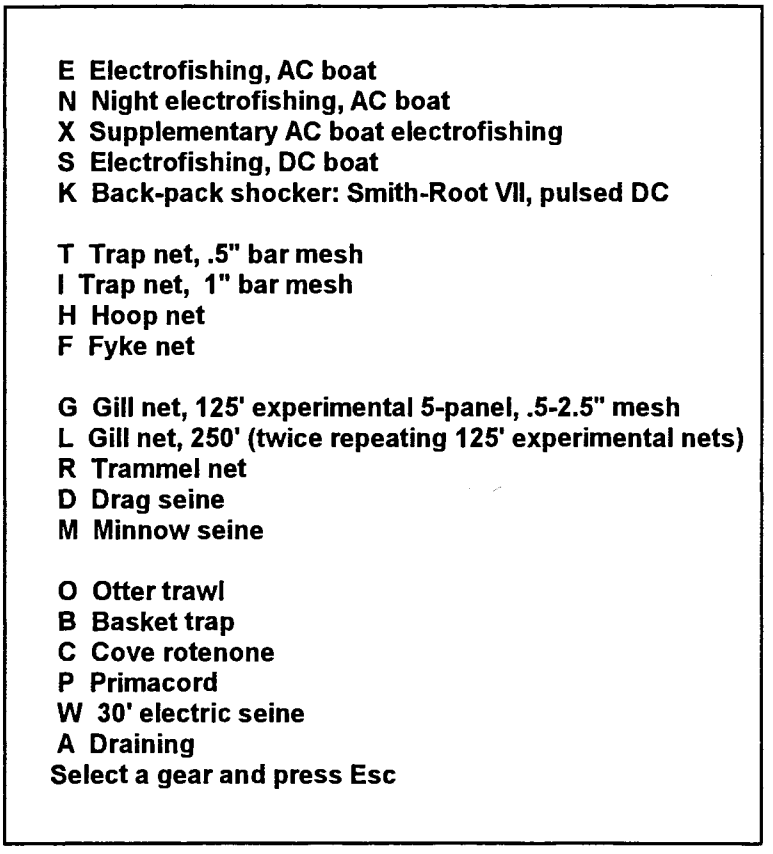


Enter data on this form in the same way as on the preceding Screen_4 form. If there are data for multiple depth entries, such as surface (0 feet), 1 ft., 2 ft., etc., press the <**Insert**> key after making the final data entry for each depth in order to save that record and call up a new blank data entry form with the same ID number. When a fresh form appears, the cursor will be positioned on the DEPTHFT line. Proceed with entering data for that depth. Once all depth profile data have been entered, press the <**Esc**> key. This, again, saves the data just entered and closes the Screen_5 table.

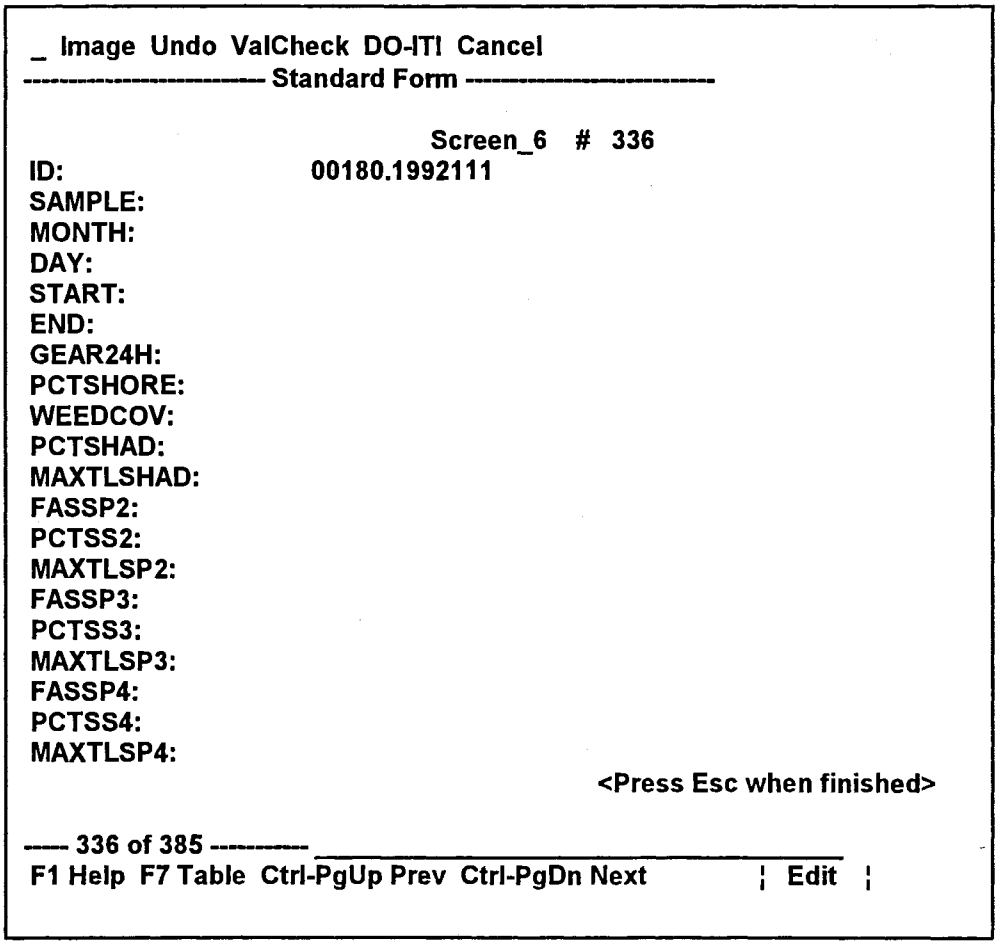
Lake Enter then automatically displays the **Enter gear/effort data now (Y/N)?** prompt for entering records to the Screen_6 table. Type <**Y**> for yes and press <**Enter**> to access the following Paradox form for Screen_6, gear/effort data.

Entering Sample Information (Screen 6)

When first entering the sample information screen you will be asked to designate a gear code from the following list:



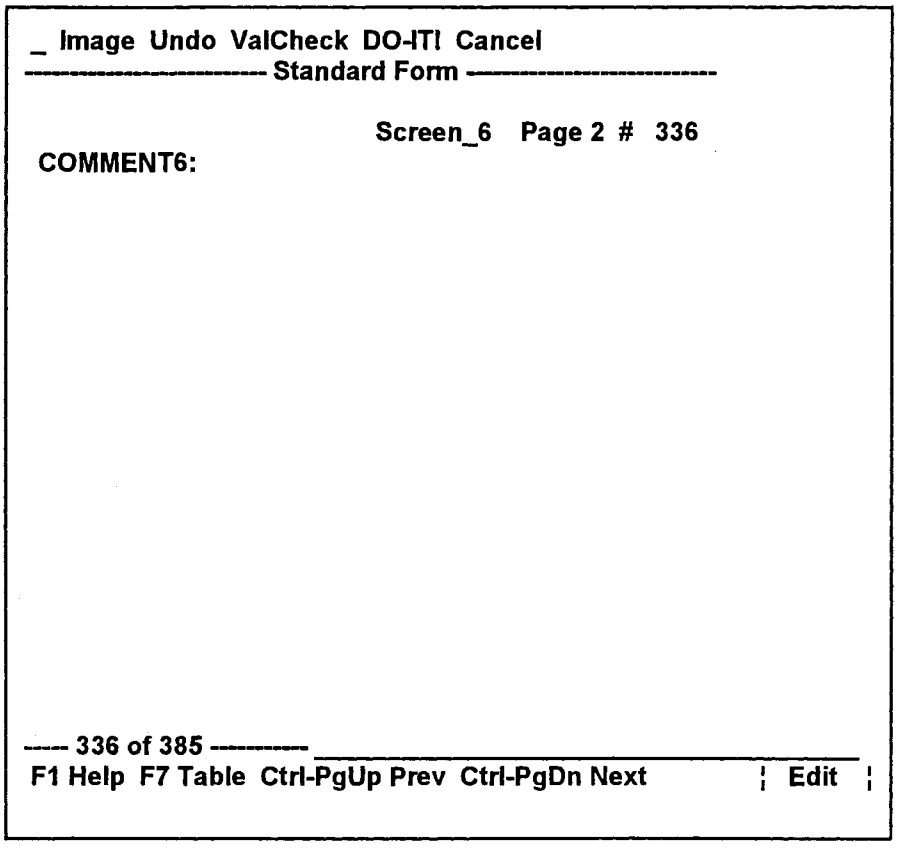
From this screen you select the proper gear by moving up or down with the arrow keys and pressing <**Esc**> when at the proper gear. You will then be queried for the run or set number for the gear. Once the gear and run are selected, you will be shown the Screen_6 data entry form (see next page). Note once again that the ID number on this form is the same as the one on Screen_4 form.



Data are entered with the Screen_6 form in the same fashion as forms for the previous two tables. For stations with multiple fish samples, such as E1, E2, G1 etc., you will need to create a separate data record for each fish sample (electrofishing run or net set) taken.

To do this, press the <**Insert**> key after completing data entry for the first sample record. The data entry procedure used for entering the first Screen_6 record will then be repeated. You will first see a display of the gear code list, from which you'll select the appropriate gear code. A prompt for entering the run or set number then appears, followed by a fresh Paradox data entry form for the remaining record information. Repeat this until you've created records for each sample taken at the station during the lake sampling trip.

Note that this lengthy form appears over TWO pages. To complete data entry for a single record, if that sample has a comment associated with it, you will need to access the second part of the Screen_6 form. The second page, shown below, is accessed by pressing the <**Page Down**> key or by using the arrow keys or <**Enter**> key to scroll past the last line of Page 1 (MAXTLSP4).



Once all sample records have been entered for a single station (ID), press the <**Esc**> key to save these records to your database. The program then returns to the main menu where you may proceed with entering fish length frequency and length/weight/age data after selecting a species code.

Entering Length - Frequency Data (Screen_7)

At this point you have selected a lake, season, station, sample and species code for which you wish to enter data. In essence, you have described the samples that you have taken and are now ready to enter the fish data describing the length-frequency distribution of the fishes. The main menu screen will appear as follows. Note that the lake selection information is complete.

```
Illinois Statewide Lake Fishes Database. Selected sample: 00180.1992111 E1

L     Select lake   GLEN SHOALS LAKE, district 20 in region 4
Y     Select year   1992
S     Select sample  Spring, station 1, trip 1, Electrofishing, AC boat
SP    Select species LMB  Largemouth bass  Micropterus salmoides
SL    Species list

N     Enter station, depth, and gear data for a new sample
LF    Enter length-frequency data
LWA   Enter length-weight-age data

F     Generate a FISHTAB input file.
G     Graph selected data
P     Paradox menu
HELP  View further instructions.
BYE   Leave Paradox

Type in your selection and press Enter:
```

At this point you will select the option LF to enter the length frequency form. The following table appears:

Length-Frequency: LMB Largemouth bass 00180.1992111 E1 GLEN SHOALS LAKE

0	200	400	600	800	1000	1200
10	210	410	610	810	1010	1210
20	220	420	620	820	1020	1220
30	230	430	630	830	1030	1230
40	240	440	640	840	1040	1240
50	250	450	650	850	1050	1250
60	260	460	660	860	1060	1260
70	270	470	670	870	1070	1270
80	280	480	680	880	1080	1280
90	290	490	690	890	1090	1290
100	300	500	700	900	1100	1300
110	310	510	710	910	1110	1310
120	320	520	720	920	1120	1320
130	330	530	730	930	1130	1330
140	340	540	740	940	1140	1340
150	350	550	750	950	1150	1350
160	360	560	760	960	1160	1360
170	370	570	770	970	1170	1370
180	380	580	780	980	1180	1380
190	390	590	790	990	1190	1390

Press Esc when finished or S for new species.

The entry form includes a range of fish lengths that should be sufficient for all Illinois species. Each length group represents a single centimeter interval, displayed as the first millimeter value within that interval. For instance, the sample frequency of 15cm fish would be entered to the right of **150**. Each interval includes fish with lengths ranging from the first millimeter value up to, but not including, the next centimeter interval. So, a frequency value entered for the **150** interval would include fish of lengths 150-159mm. Each frequency value entered will be saved as a separate record within the Screen_7 data table.

The cursor is easily moved within the form by using the arrow keys (all four keys are functional) or the <**Enter**> key to move down to the next line. You can move forward, backwards or sideways within this form. Simply move the cursor to the right of the corresponding length group, enter the fish count for that interval, and reposition the cursor to the next length group that had fish. There's no need to enter 'zeros' for length intervals without fish. Note that this table will not automatically account for any individual fish records entered into the database. The frequency entered for each length interval should be the total number of fish of that size actually collected in that sample for the selected species (individually measured fish + "hashed" fish). Likewise, there's

no need to scale up the frequency value for subsampled species.

Entering additional species length frequency data from the same sample

When you have completed data entry for the selected species, you can proceed with entering length frequency data for another species from the same sample by pressing <**S**>. <**S**> may be pressed with the cursor positioned anywhere within the length frequency data entry form. It won't overwrite any existing value that you have entered with the letter "S".

Once pressed, the prompt "**Enter the 3-letter code for the species:**" will appear above the current Screen_7 data entry form. Simply enter the three letter code for the next species and press <**Enter**>. If the appropriate species code is unknown, for instance if the common name of the fish species, rather than the species code, appears on the field sheet, simply press <**Enter**>. The data entry program will display a list of all fish species within the Species tables, which can be searched in a similar manner to the lake selection process described earlier for the Waters table. To select a species code in this manner, move the cursor down to the desired species record, in any field, and press <**Esc**>. A new data entry form will then appear for the selected fish species.

Length frequency data for all species within the sample can be easily entered this way. When data for the last species have been entered press <**Esc**>, rather than <**S**>, to save your entries and return to the main menu. If <**S**> is pressed by mistake, simply press <**Esc**> at the "**Enter the 3-letter code for the species:**" prompt to return to the main menu.

Entering Data for a Different Sample from the same Sampling Trip

Since Screen_7 records are specific to a single sample, you will need to change the sample selection displayed in the Lake Enter main menu, before entering additional length frequency data. For instance, if you have just entered all fish length frequency data for sample E1 and wish to enter fish data collected from sample E2, you must first <**Esc**> back to the Lake Enter main menu and specify the E2 sample. Selection of a different sample depends on whether a record for that sample has been entered into the database:

(A) Specifying a new sample, from the same sampling trip and station, when a record for that sample has already been entered into Screen_6:

If the sample has already been entered into Screen_6, choose the <**S**> option from the Lake Enter main menu: "**Select sample**". The program will then display a list of all samples in the current database (from the Screen_6 table) for the Lake-Year-Season-and Station (i.e., the **ID** value) presently selected. Use the arrow keys to position the cursor in the record corresponding to the sample for which you wish to enter length frequency data and press <**ESC**> to select the sample. You will then be returned to the Lake Enter main menu. Select the appropriate fish species code using the **SP** command and proceed with length frequency data entry by choosing either main menu option **LF** or pressing <7>.

(B) Specifying a new sample, from the same sampling trip but different station, when a record for that sample has already been entered into Screen_6:

For instances where you need to select a different station as well as a different sample, you will first need to remove the selection criteria for the current station. For instance, you wish to begin CCF length frequency data entry for Glen Shoals Lake, Station 2, Sample E1.

To clear the lake or year selection, choose the appropriate Lake Enter main menu option (L or Y) and press <Esc> when asked to enter a lake name or year. By default the current sample selection will also be automatically cleared, when either the lake or year value is cleared, since both are part of the sample ID .

In the case of selecting a new station, clear the Year selection to clear the current sample selection, then reenter the Year selection by choosing the **<Y> Select year** option again, and enter the two or four-digit number for the year of the sampling trip.

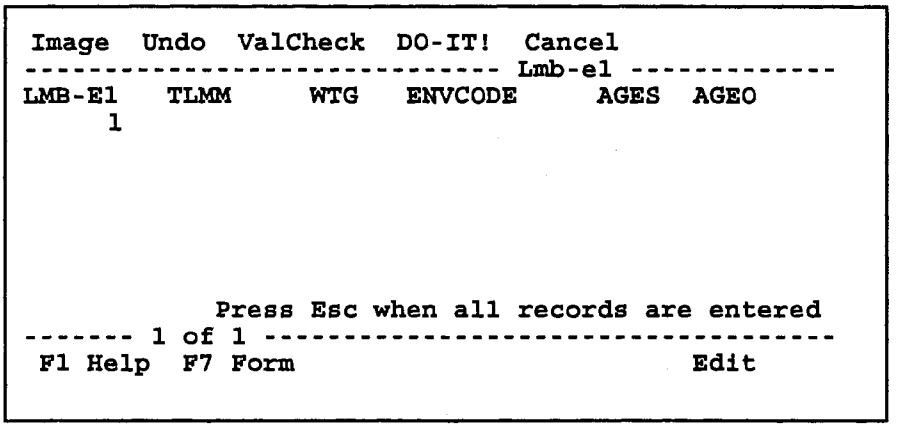
Next, choose the **<S> Select sample** option. A list of all season-trips and stations within the current database will be displayed for the lake and year that you've selected. For instance, if Glen Shoals Lake has three stations and had all been sampled in the spring and fall of 1996, you would see six records displayed: one for each station sampled in the spring and one for each station sampled in the fall. Position the underscore cursor, using the arrows keys, into the appropriate record for the season-trip and station for which you wish to enter length frequency data and press **<Esc>**, to select that station.

Finally, a list of samples within the database for that station will appear. Move the cursor to the record of the sample that you wish to select and press **<Esc>** again. You will then be returned to the Lake Enter main menu, fully selected on a lake, year, season-trip, station, and sample. Complete the selection process by selecting a fish species with the **SP Select species** option and proceed to the Length Frequency form by choosing main menu option **LF Enter length-frequency data** or <7>.

Note that data entry for Screen_4, Screen_5, Screen_6, Screen_7, or Screen_8, may be invoked either by using the main menu options of 'N', 'LF', or 'LWA' *or* by pressing the number corresponding to that table. Using either approach, however, requires that you be appropriately selected on the necessary set of Lake, Year, Season Trip, Station, Sample and/or Species values before proceeding with data entry.

Entering Length-Weight Data (Screen8)

Once length-frequency data has been entered, you can next enter the length/weight/age data by selecting the LWA option from the main menu of the data entry program. Note that as with entering length-frequency data, you must have the lake, season, station, sample and species code already selected. The following screen appears:



Note that the species and gear code selected automatically appear as the name of the temporary table within Paradox to accept this data. Enter the length (in *millimeters*), weight (*in grams*), and age data (under **AGES** for *scale* readings or **AGEO** for *otolith* readings) into this form by typing in the appropriate values and pressing the <**Enter**> key to advance to the next column. The cursor keys are also active on this form, and may be used to move the cursor from one field to the next. After entering data for a single fish, press on the < ↓ > to begin the next fish record or continue pressing <**Enter**> to advance the cursor through the remaining age fields until a new record appears on the form. Once data for the last fish has been entered, press the <**Esc**> key to save all of the records for that species and return to the data entry program main menu. If additional fish species were collected in the selected sample, select a new species code with the **SP Select species** option and choose **LWA** to continue entering length-weight-age data. Continue this process until individual fish data from all species from the selected sample have been entered.

You have now completed data entry in the FAS Lakes database for one station and gear code. Repeat this procedure for subsequent samples. Congratulations!

FORTH PACKAGE: Graphics and Age Table

Graphical output from FAS-Lakes databases is produced using riForth™. Version 2.0 of the FAS-Lakes Forth Graphics package has incorporated all of the plots available in the ISYS FORTH Graphics of the DOC9 General Manager/Apple//e system. These include:

1. Length-frequency histogram -- number of fish within each of a series of user-specified length groups (from either 1- to 5-cm per group or using user-defined intervals).

2. Length-Weight regression -- plots individual fish length:weight records with length (mm) as the x-axis and weight (g) as the y-axis. Both scales are logarithmic.

3. Condition factor graph -- calculates the average condition, either as Kn or Wr, as well as 95% confidence intervals for fish of each length group specified. Averages are then plotted with length (mm) on the x-axis and condition factor on the y-axis.

4. Individual Length at Age -- plots the length of individual fish against their respective ages. Age is represented by the x-axis, while length (mm) is on the y-axis.

5. Mean Length at Age -- plots mean length of fish age classes, as defined by the user (see the discussion of the GROUP command below for details on defining age by fish length intervals).

6. Age Table -- Tabular display of minimum, maximum, and mean length, mean weight, mean relative weight (Wr) condition index, and number of fish within each user-defined age group.

7. Biomass at Length Histogram -- identical to the Length-frequency Histogram, except that the estimated total weight of fish is displayed for the series of length intervals chosen by the user. Biomass is estimated by the standard species length-to-weight relationship.

Creating Graphs - Data Selection

To produce plots of FAS-Lakes data, you must first select the data to be plotted. Data are selected and exported to the Forth graphics module using the Lake Enter program's main and secondary selection menus. The selection process, specifying which data to plot, is a two-step process. The first step is the same as that used in the data entry process. The selection process works on the database currently specified at the startup of the Lake Enter program. Here, selections may be made on Lake (Option L), Year (Y), Sample (S), and Species (SP). Remember that within Lake Enter's main menu you are restricted to setting your selection to either one or all values for a given selection option. For instance, if you wish to select specific data for Graphics from a given lake-sampling trip, you may select all data from that sampling trip (e.g., all 1996 walleye data for from Lake Shelbyville) or data from a single run from that lake and year (e.g., walleye data from station 1, electrofishing run #1). However, the main menu offers no direct way of selecting multiple sets of data for a given selection option. For instance, you wouldn't be able

to specify walleye data from all electrofishing runs made at station 1 of Lake Shelbyville during the 1996 sample trip.

In order to specify data from multiple species, samples, years, or lakes a second selection menu is used within Lake Enter. This secondary selection menu appears whenever you choose **Option G. Graph selected data**. The same menu also appears when **Option F. Generate a FISHTAB input file** is chosen from the main Lake Enter menu. So, when starting the data selection process for Graphics, use the Lake Enter main menu to set broad (i.e., no selection) or very specific selection criteria for lake, year, species, and/or sample. Use the secondary selector to refine or expand your initial selection conditions. Shown below is an example of selecting data for Forth Graphics from the main menu of Lake Enter. Selection criteria entered by the user are shown in bold text.

```
Illinois Statewide Lake Fishes Database.  Sample_, sample 00059.1987..


L    Select lake    HEIDECKE LAKE, district 11 in region 2
Y    Select year    1987
S    Select sample
SP   Select species LMB  Largemouth bass  Micropterus salmoides
SL   Species list

N    Enter station, depth, and gear data for a new sample
LF   Enter length-frequency data
LWA  Enter length-weight-age data

F    Generate a FISHTAB input file
G    Graph selected data
P    Paradox menu
HELP View further instructions
BYE  Leave Paradox

Type in your selection and press Enter:
```

Secondary Selection Menu for Graphics

Once criteria have been set from Lake Enter's main menu for the data set that you intend to use with Graphics, the option:

G Graph selected data

is chosen to generate the two data input files that Forth graphics requires, namely the species raw length-frequency or RLF file and the species length-weight-age or LWA file. Before Lake Enter automatically generates these files and starts Graphics, though, a second selection menu appears, which allows you to modify or expand upon the selection criteria just entered within the main

menu. In addition to Lake, Year, and Species, options are given to specify your graphics data set by Season-Trip, Station, and Gear. Unlike the main menu, you may select several to many values for a given selection criterion. For instance, data from several lakes may be specified for your graphics input file, or several stations from a single lake sampling trip may be specified. The secondary selector permits multiple specifications on any combination of all six selection criteria, thereby making the ultimate selection of data to Graphics as specific or general as you like.

An example of the secondary selector screen, based on the selections made in the Lake Enter main menu from the example above is shown below:

```
L       Lakename          HEIDECKE LAKE
Y       Year              1987
SE      Season-trip       ALL
ST      Station           1
SP      Species           LMB
G       Gear              E G T

M       Make a file with the following name
R       Run analysis on a file with the following name
Enter   Create a file named TEMP and run analysis
Esc     Return to the main menu

Separate multiple selections by spaces (or commas for lakenames).
File name extensions are fixed. Any supplied by you will be ignored.

Type in the command followed by your selection(s):

   G  E G T
```

When the secondary selection screen first appears, any criteria that you have set within the main menu appear next to the appropriate selection criterion. In this example, selection criteria have been set for Lake, Year, and Species (shown in *italics*), and thus serve as the starting point for any further conditions for selecting your Graphics data set. If criteria have not been set for a selection option (e.g., no specific year has been set) then the secondary selection menu displays the criteria for that option as **"ALL"**.

To set or redefine any selection criteria for your data set, press the letter(s) corresponding to the criteria that you wish to use (L, Y, SE, ST, SP, or G) followed by a space. Then enter the value or values that you wish to select. Each condition value that you wish to select must be separated by a space, except lake names which are separated by a comma.

For example, to specify data from Stations 1, 3, and 5 of a specific lake you would type:

ST 1 3 5 <Enter>

while specifying a data set that includes fish from three ponds might be entered as:

L POND#1,POND#2,POND#3 <Enter>

or to specify a data set of walleye, sauger, and saugeye, you would type:

SP WAE SAR WSH <Enter>

Remember multiple LAKE selections are always separated by a comma (,) with no spaces between the comma and lake names. All other selection options (**Y**ear, **SE**ason, **ST**ation, **SP**ecies, **G**ear) require a space between each criterion. In the above example, additional criteria have been set on Station (**ST 1** <Enter>), and type of gear (**G E G T** <Enter>).

Selection criteria already set within the main menu of Lake Enter may also be modified with the Secondary Selection Menu. For instance, if you initially selected Heidecke Lake in the main menu and wished to expand this to include fish from Braidwood Lake, you'd type:

L HEIDECKE LAKE,BRAIDWOOD LAKE <Enter>

To correct or completely change the criteria set for a selection option, type the letter(s) of the menu selection option followed by all of the criteria values that you wish to use for your selection. For instance to change your lake selection from Heidecke Lake to Braidwood Lake you'd type:

L BRAIDWOOD LAKE <Enter>

Selection criteria may be entered in upper or lowercase and the criterion for year may be entered either as the full four-digit year or as the last two digits (just as in the main menu).

Once all selections have been set, you have four options for proceeding:

(1) **<M>** followed by a space and a filename (up to eight characters without a three-letter extension) will automatically generate RLF and LWA graphics files based on your selection conditions, save them to your \NEWFAS directory using the file name that you have specified, then start Forth Graphics. For example:

M BASS <Enter>

generates two graphic data input files from your database: BASS.RLF and BASS.LWA.

(2) **<R>** followed by a space and a filename will automatically start Forth Graphics without generating new RLF and LWA files. This option is used in instances where you've previously generated a pair of graphic data input files and wish to go directly into Graphics to create plots. For example:

R BASS <Enter>

instructs the program to start Graphics using data from BASS.RLF and BASS.LWA . Both files

must exist and be located in the same directory as your database (\NEWFAS) for Graphics to run properly. If Graphics fails to find either file, the program will still start-up Forth Graphics. However, any plot command will result in the error message:

DISK

(3) <**ENTER**> alone will automatically generate RLF and LWA graphics files based on your selection conditions, save them to your \NEWFAS directory as **TEMP.RLF** and **TEMP.LWA**, then start up Forth Graphics. Like the **TEMP.TAB** file generated for FISHTAB, **TEMP.RLF** and **TEMP.LWA** are the default data input files for Graphics. Being default files, they are only temporary. Data within these files will be overwritten the next time <**ENTER**> is chosen from the secondary selection menu of Graphics.

(4) <**ESC**> alone will return you to the main menu of Lake Enter, without generating .RLF or .LWA files. However, your secondary selection menu criteria will be saved in memory and will still be used if you chose the option of **G Graph selected data** again before exiting the Lake Enter program.

One last word about setting selection conditions - only one selection option exists within Graphics - that for specifying species. Any plot generated by Forth Graphics will use ALL data within the RLF or LWA files for that species. THEREFORE, BE CERTAIN THAT YOU ARE AS PRECISE AS NECESSARY WITH YOUR SELECTION CRITERIA BEFORE PROCEEDING TO FORTH GRAPHICS.

Creating Graphics - Forth Interface

When graphics is invoked a full black screen will appear with the title:

```
riFORTH  Copyright Robert F. Illyes, 1990-1996
```

All commands within FORTH Graphics are presently entered in a command line fashion, just like DOS commands. The mouse is also disabled within Forth Graphics with the exception of the **MOUSE** command discussed later in this section.

Note that all commands in Forth must be in UPPERCASE followed by pressing the <Enter> *key.* Forth commands are executed by typing them directly into the computer. If a command is misspelled, simply backspace over the command and retype it. Misspelled commands do not create serious errors within Forth Graphics. Forth will simply redisplay of the command followed

by a question mark, "?" . The appearance of a question mark following a word always indicates an error in entering a command.

Essential Graphics Commands

Commands which should be executed *PRIOR* to creating plots:

SPECIES ***Species code***
The **SPECIES** command specifies the species data from your .RLF and .LWA files which will be plotted within any graphs that are created. The format of the command is **SPECIES** followed by a space, the three letter code of the species, and **<Enter>**. For example, to specify largemouth bass you'd type:

SPECIES LMB <Enter>

If the species code is legal, Forth will respond with the common name of the species followed by "ok". For the example above you would see:

Largemouth bass ok

appear immediately after the **SPECIES** command that you entered. **SPECIES** also reads into memory the intercept (*a*) and slope (*b*) parameters of the specified species standard length to weight relationship, used in the calculation of LeCren's Condition index, Kn, as well as the standard weight *a* and *b* parameters used in calculating the Relative Weight condition index, Wr.

LASER
This command is used to specify that any plots or tables created will be sent to a Postscript printer, such as the Hewlett Packard LaserJet laser printers.

LQ
This command specifies that any plots or tables created will be sent to a dot matrix printer, such as the Epson LQ-870. Forth Graphics, by default, is configured for this type of printer, so this command only needs to be given if you switch from a Postscript to a dot matrix printer.

Special note for users of HP DeskJet printers:
HP Deskjet printers will handle tabular output but currently will not handle graphic outputs. The output looks interesting - smile face characters and other assorted gibberish, but it definitely bears no resemblance to the plot that you've created on the screen. As of December 1996, a special printer driver will be required to permit graphical output to these printers. This driver should be available for users of Forth Graphics before the end of January 1997.

SCALE
Specifies that all age data come from scale readings (Screen8 field *AGE_S*). This is the default setting of Graphics, so use this command only if previous plots have been based on otolith age data.

OTOLITH
Specifies that all age data come from otolith readings (Screen8 field *AGE_O*).

Other essential commands:
HELP
Perhaps the most useful of all Forth commands! This command displays a list of all Forth graphics commands, followed by a brief description of what the command does. **HELP** lists help in two formats. The initial page of **HELP** lists the following:

```
GRAPHS:             AGE/L  AGE/ML  BIOMASS  HISTO  KN  L/WT  WR
GRAPH SCALE:        HIGH  WIDE  MOUSE (with L/WT only)
GRAPH ADDITIONS:    AGE  KNLINE  WRLINE
A & B PARAMETERS:   AB  AB?  KN!  SPECIES
GROUPINGS:          ONE  TWO  THREE  FOUR  FIVE  GROUP SEE
AGE TYPE:           SCALE OTOLITH
PRINTING:           PRINT FILE LQ LASER

TXT    turns off graphics.
MORE   extra help pages.
SAVE   saves the current state of the system
BYE    ends a graphics session.

Start from the DOS command line with GRAPH TEMP, or with your
filename instead of TEMP. Files TEMP.RLF, TEMP.LWA, and
SPECIES.TXT will be used.

 ok
```

The **MORE** command, then gives a three-screen detailed discussion of these commands:

Page 1 of the detailed help screen displayed by the **MORE** command:

```
GRAPHS          **** All Graphics commands must be entered in UPPER case! ****
-------------------------------------------------------------------------------
-
     HISTO      Length-frequency histogram. The number of fish (corrected for
                for subsampling) within each length interval is displayed.
     L/WT       Length-Weight scattergram of individually measured fish.
Scales
                are logarithmic with length in mm and weight in grams.
     AGE/L      Individual Length at Age scattergram. Lengths of individual
                fish are displayed against fish age.
     AGE/ML     Mean Length at Age plot. Plots mean age of fish within
                length classes as set by the GROUP command.
     KN         LeCren's Condition Factor Plot. Mean Kn values are plotted for
                each length interval, along with  95% confidence intervals.
     WR         Standard Weight Condition Factor Plot. Mean Wr values and
                95% confidence intervals are plotted for each length interval.
     BIOMASS    Length-total weight histogram. Displays total weight in grams,
                using length to weight conversion of fish in each length
group.
.
GRAPH SCALE
-------------------------------------------------------------------------------
-
     <#> HIGH   Set the upper limit of the Y-axis (e.g., 20 HIGH).
     <#> WIDE   Set the upper limit of the X-axis (e.g., 100 WIDE).
     MOUSE      With L/WT only, activate the mouse. The length and weight
                values at the mouse cursor are displayed.

Press any key to continue:
```

Page 2 of the detailed help screen displayed by the **MORE** command:

```
GRAPH ADDITIONS
--------------------------------------------------------------------------------
     AGE         Display individual fish ages above lengths for histograms
                 and condition plots.
     WRLINE      Display a standard species length-weight regression line
                 using the currently selected Wr parameters.
     KNLINE      The Kn equivalent of WRLINE.
.
A & B PARAMETERS
--------------------------------------------------------------------------------
     SPECIES <species code>  Specify the species to be plotted.
     AB          Calculate a length-weight regression for the selected data.
                 The new a and b parameters may then be used with Kn plots.
     AB?         Display a and b parameters currently used for Kn or Wr plots.
     <a> <b> KN!  Replace Kn a and b values with user-entered values.
.
DATA GROUPINGS FOR HISTOGRAMS AND CONDITION PLOTS
--------------------------------------------------------------------------------
     ONE  TWO  THREE  FOUR  FIVE  Set grouping intervals to the stated number
                 of centimeters.
     GROUP <name>   Create user-defined length groups.
     SEE         Display the current length group settings.

Press any key to continue:
```

Page 3 of the detailed help screen displayed by the **MORE** command:

```
AGE TYPE FOR AGE, AGE/L AND AGE/ML PLOTS
--------------------------------------------------------------------------------
     SCALE       Specify that only SCALE age data are to be used.
                 This is the default setting.
     OTOLITH     Specify that only OTOLITH data are to be used.
.
PRINTING AND MISC.
--------------------------------------------------------------------------------
     PRINT       Print the graph being displayed, or a group table if no graph.
                 Any text following the command is used as a legend for the
                 printout.
     FILE <filename> Send the next graph or table printed to the named file.
     LQ          Set the printer type to an Epson LQ. This is the default.
     LASER       Set the printer type to a PostScript laser printer.
     TXT         Changes the screen display from graphics to text only.
     SAVE        Permanently saves the current settings for printer and age type
                 (scale or otolith) as well as any user-defined length groups
                 created with the GROUP command.
     BYE         EXIT Graphics and return to Data Entry or DOS/Windows.
.
FORTH Graphics may be started from the DOS command line by typing
"GRAPH TEMP" or with your graphics filename rather than TEMP.
```

BYE
Arguably the other most useful command, BYE allows you to exit Forth Graphics and returns you either to the Lake Enter program, to DOS or WINDOWS.

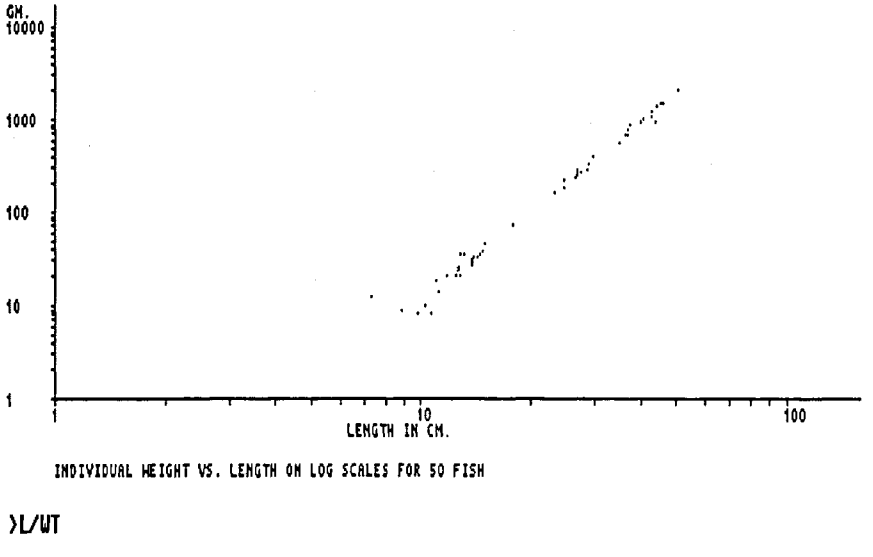
SAVE
Permanently saves any group definitions to the Forth Graphics program as well as the current setting for printer type (i.e., sets either LQ or LASER as the default printer the next time Graphics is run) and source of age data (i.e., SCALE or OTOLITH). Use this command ONLY when you wish to save a frequently used group definition for analyzing age data or if you most frequently use otolith data or print to a Postscript printer.

COMMANDS WHICH CREATE GRAPHS:

L/WT
L/WT produces the length-weight regression plot. To produce this plot just type:

L/WT <Enter>

This allows you to identify *outliers* (data points that may be erroneous); they can be later erased or corrected in the FAS-Lakes database. If data appears to be missing from this graph be sure to check the width and height values because they may not be appropriately set for the data you are analyzing.



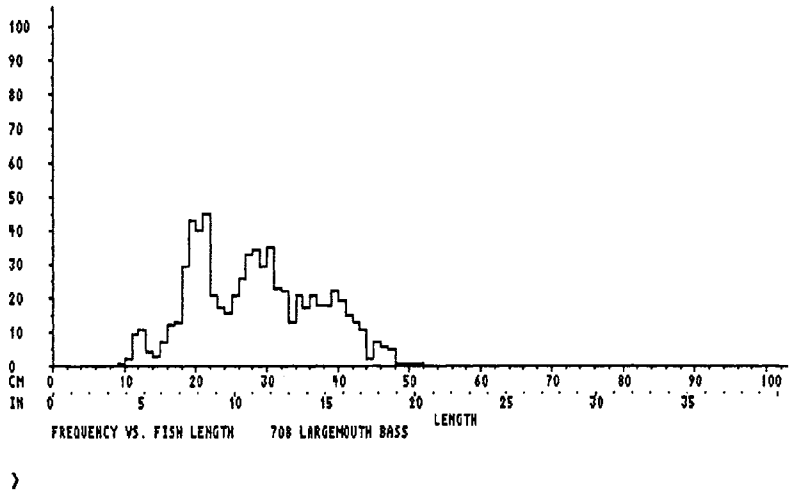
An example of an L/WT plot for largemouth bass data from Heidecke Lake - Fall 1987.

Axes scales in length-weight scatterplot can be altered by using the commands **HIGH** and **WIDE**

as described later in this section.

HISTO
produces the length-frequency histogram. To obtain a histogram, type the command:

HISTO <Enter>



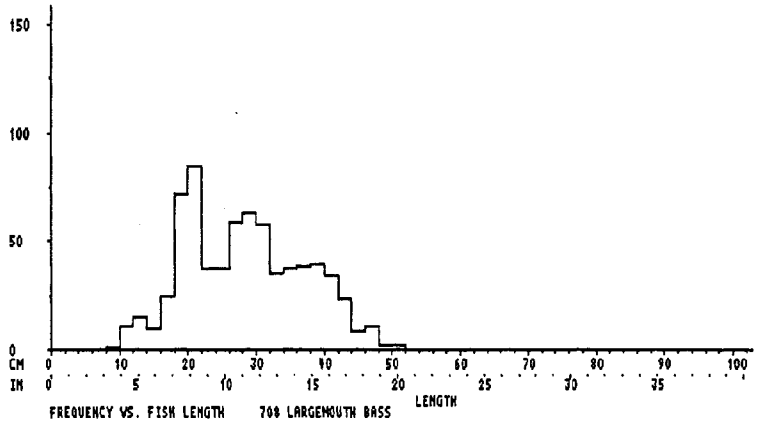
An example of a Length Frequency Histogram for Largemouth Bass - Heidecke Lake 1987.

By default, the total number of fish are displayed for each 1-cm length interval. Ages of fish within each length interval may also be plotted above their corresponding centimeter groups. To do this, follow the instructions given for **AGE**. Histograms may also be plotted using length intervals of two, three, four, and five centimeters to group fish, as well as user-defined group intervals (see the **GROUP** command). The initial maximum value for both axes of histograms are usually far in excess of what is necessary for the data being displayed. As with **L/WT**, the x-axis maximum may be set with the **WIDE** command, while the y-axis maximum is set by the **HIGH** command.

Commands which vary the length interval used to group fish within Length Frequency Histograms:

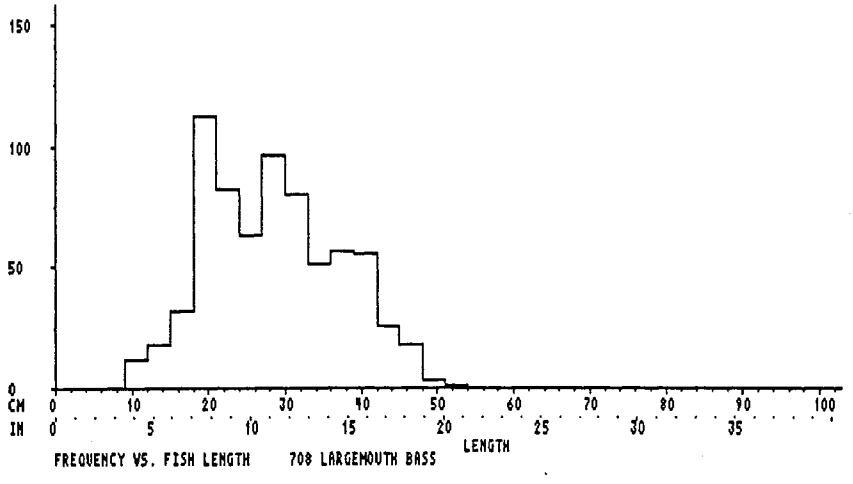
ONE HISTO--plots a length-frequency histogram with one-cm groups. This is the default for HISTO but using ONE HISTO would be necessary to return to 1-cm groups after setting groups to different sizes.

TWO HISTO--same as previous command, but in 2-cm intervals. For example, the length frequency histogram shown below would appear as follows using **TWO HISTO**:



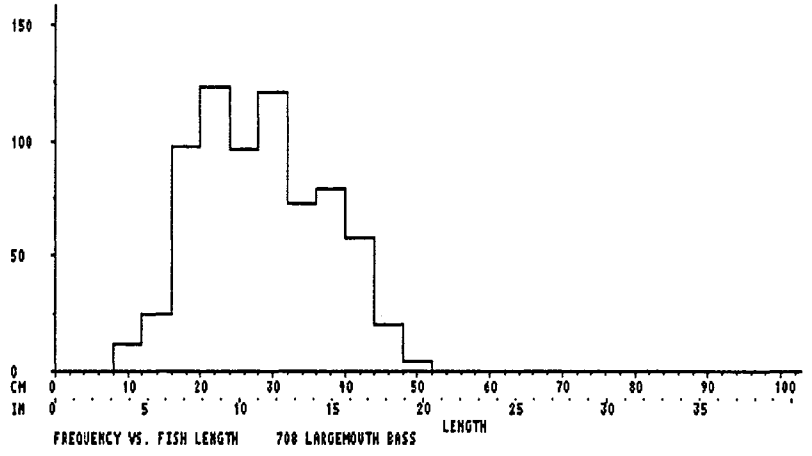
>TWO HISTO

THREE HISTO--same as previous command, but in 3-cm intervals.



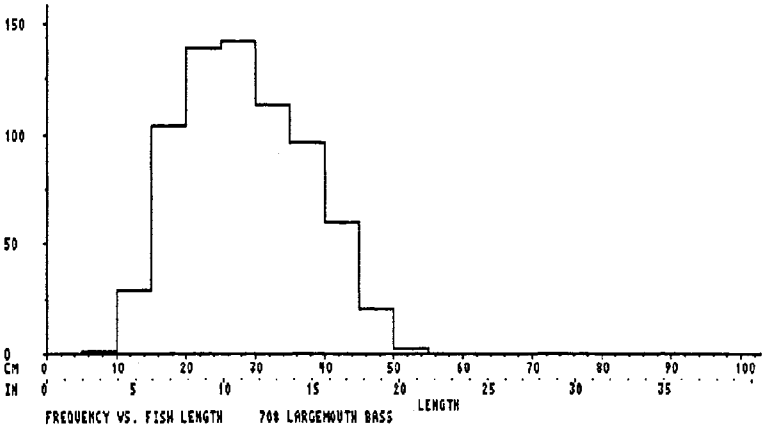
>THREE HISTO

FOUR HISTO--same as above, but in 4-cm intervals.



>FOUR HISTO

FIVE HISTO--same as above, but in 5-cm groups.

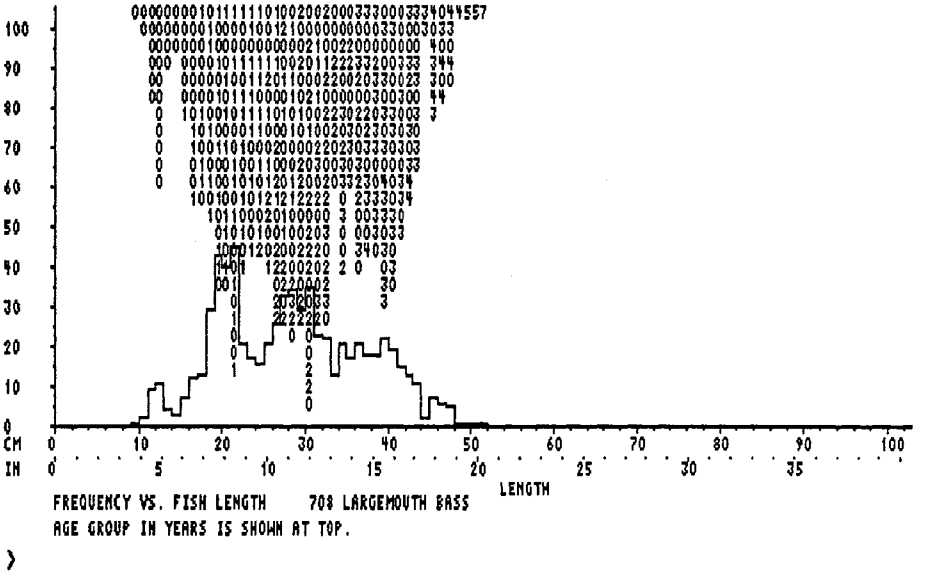


>FIVE HISTO

AGE

Plots individual age data over respective lengths in the length-frequency histogram. The ages will appear at the top of the screen over the length groups. The number shown is the age of the fish and each number represents an individual fish. Therefore, if a column has one *2* and two *3's* there is one fish of age 2 and two fish of age 3 in that particular length group. This command may also be used with the Relative Weight Histogram (**WR**) and LeCren's Condition Factor Histogram (**KN**).

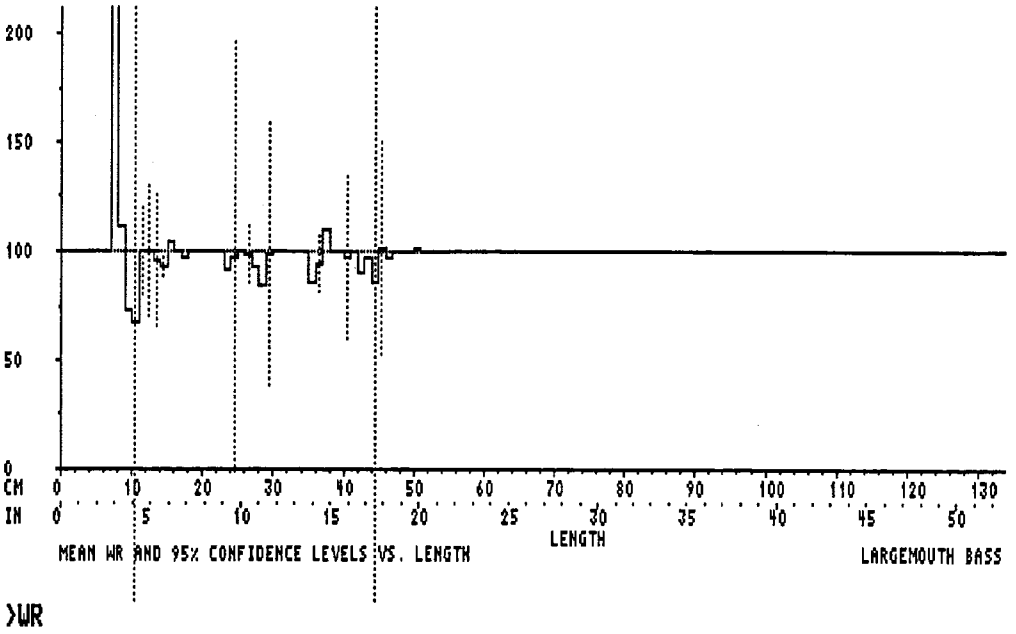
Note: Ages greater than nine years are represented by letters rather than numerically, starting with A = 10, B = 11, C = 12 and so forth. Letters are used to represent the ages of these older fish due to space constraints imposed by the graph and to prevent misinterpretation of older ages as the ages of two younger fish.



Example of AGE being used with a length frequency histogram of largemouth bass data.

WR

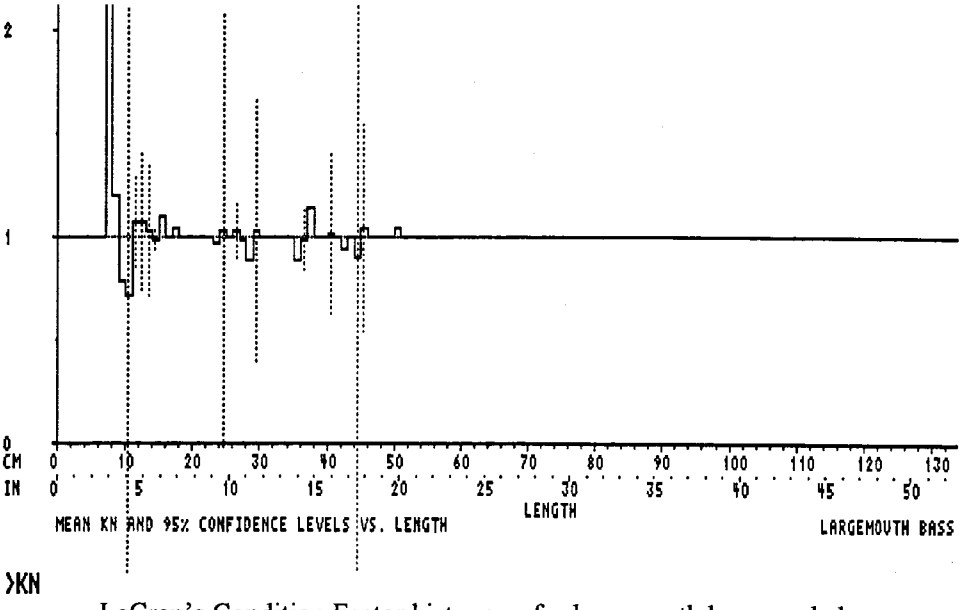
Relative Weight Histogram. The mean WR value is shown by the horizontal line above the centimeter group and the 95% confidence interval is given by vertical dots. Any grouping commands may also be used for producing WR graphs (e.g., **TWO WR**). To use user-defined group intervals created through the **GROUP** command, simply run through the grouping procedure first or recall previously defined groups (by typing its group name) before producing the **WR** graph. The *a* and *b* parameters used for calculating standard weight values are determined by the species selected for the plot by the **SPECIES** command, prior to the **WR** command.



Relative Weight Histogram for largemouth bass data used in previous examples.

KN

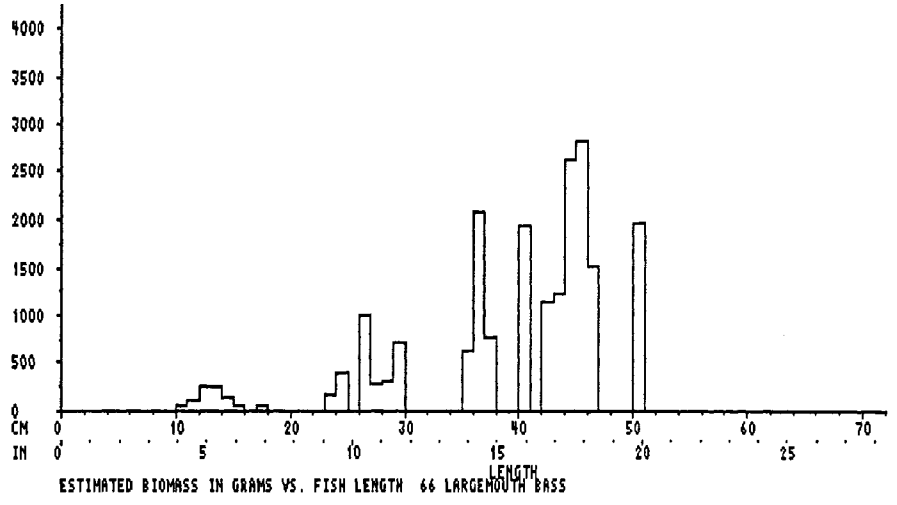
LeCren's condition factor histogram. This histogram is produced in a similar manner to **WR** plots.



LeCren's Condition Factor histogram for largemouth bass used above.

BIOMASS

Length Biomass Histogram. This histogram is similar to the length frequency histogram produced by **HISTO**. Rather than plotting the total number of fish for each length interval, the estimated total weight of fish within the length interval is plotted. Weight is estimated based on the average length of fish within the length interval, converted to grams using the standard length-weight relationship for the species selected.



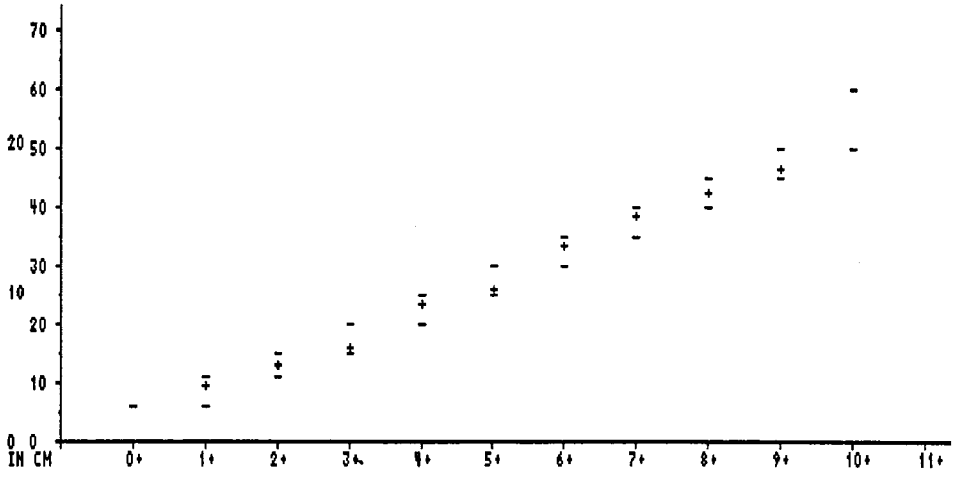
>BIOMASS

AGE/L

Individual Length at Age Graph. Lengths of individually measured fish are plotted on the y-axis against their respective ages on the x-axis. Ages are based on either scale or otolith data depending on whether the **SCALE** or **OTOLITH** command has been executed prior to creating the **AGE/L** plot. There currently is no option to plot both sets of age data together.

AGE/ML

Mean Length at Age Graph. Plots mean length of age classes based on the interpretation of the user. Length ranges for defining age cohorts are set by the **GROUP** command **prior** to entering the **AGE/ML** command. Means are plotted as points above each age tic mark with the 95% confidence interval about each mean plotted by vertical bars.



MEAN LENGTH VS AGE FROM LENGTH-FREQUENCIES (WITH CHOSEN RANGE OF LENGTHS AT AGE).

>AGE/ML

Example of AGE/ML plot for a hypothetical grouping of largemouth bass data.

Commands That Modify Graphs

HIGH

The command **HIGH** preceded by a number adjusts the height of any graph (*e.g.*, 200 HIGH makes the y-axis extend to 200 units). You must enter numbers as integers (*i.e.*, without decimals).

WIDE

The command **WIDE** preceded by a number adjusts the width of any graph.
(*e.g.*, 50 WIDE for a length-frequency histogram makes it 50 cm wide). Enter numbers without decimals. You may combine commands HIGH and WIDE into one statement
(*e.g.*, 200 HIGH 50 WIDE).

Both of these commands may also be used on the same command line as the command that creates a plot. For instance, for a histogram that you wish to rescale to an x-axis of 100 and y-axis of 500 you may type:

100 HIGH 500 WIDE HISTO <Enter>

or

500 WIDE 100 HIGH HISTO <Enter>

rather than typing each command separately:

100 HIGH <Enter>
500 WIDE <Enter>
HISTO <Enter>

Commands Related to Standard Length:Weight Parameters

Note: For any of the following commands to work properly, you must first select the fish species for the data that you will be working with, using the SPECIES command.

AB?

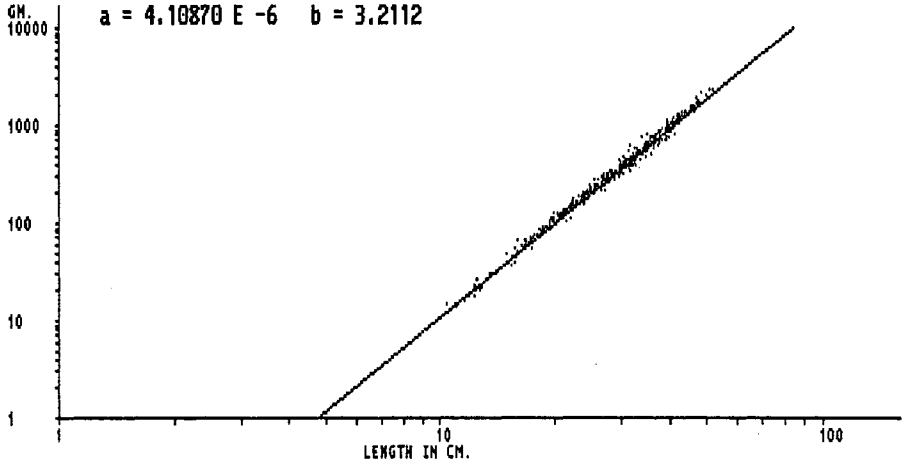
AB? displays the current *a* and *b* parameters used for **KN** or **WR** plots. This value is based on either the standard species parameters read into Graphics through the **SPECIES** command or calculated from the selected set of data using the **AB** command.

AB

AB calculates a length to weight regression equation based on the selected data. Intercept (*a*) and slope (*b*) parameters from this equation are then used for the **BIOMASS** and **KN** histograms.

KNLINE

Plots a length-weight regression line over scatterplots (**L/WT**), based on the currently selected or calculated *a* and *b* parameters for LeCren's Condition Factor. These parameters are also displayed at the top of the plot.



WRLINE

Plots a length-weight regression line over scatterplots (**L/WT**), based on the currently selected or calculated *a* and *b* parameters for the Relative Weight Condition Factor. These parameters are also displayed at the top of the plot.

***a b* AB!**

User input of the *a* and *b* parameters to be used with the KN, WR, or BIOMASS commands. **AB!** is preceded by the *a* value, followed by a space, then the *b* parameter. Both values must be entered as decimal numbers. For example, manual entry of the parameters displayed above with the ABLINE plot would be:

.00000410870 3.2112 AB! <Enter>

The GROUP command and AGE table creation

GROUP allows the user to create length groups of any size (such as those for various age classes) and then plot mean condition factors with these groups in the AGE table or to produce Mean Length at Age plots with the **AGE/ML** command. The format of the command is:

GROUP ***group-name*** <Enter>
where ***group-name*** can be any single word name that you choose.

If a GROUP file by this name already exists, either created during your current Graphics session or saved with the **SAVE** command during a previous Graphics sessions, then simply type the name of the group to load it's length interval definitions into memory. For instance:

GROUP BASS <Enter>

creates a group file named **BASS** and starts the process of defining groups of fish by length for consecutive age, while:

BASS <Enter>

loads a previously defined GROUP file into memory for use with **AGE/ML** plots.

Creating a GROUP

Once the GROUP command has been entered with a designated GROUP file name, Forth begins the process of defining the first age group. This begins with the question:

Enter the minimum age 0+ cm length:

respond with the lowest length *in centimeters* that you wish to use for defining young of the year fish and press **<Enter>**.

Next, you'll be asked to enter the maximum length which will define young-of-the year fish:

Enter the maximum age 0+ cm length:

Again, enter an appropriate centimeter length for the fish species that you've currently selected for analysis. At this point a display of the group that you've defined appears at the top of the screen and the GROUP routine continues by asking you to enter the maximum length of the next age, namely AGE 1 fish:

```
AGE   MIN LENGTH   MAX LENGTH   MEAN LENGTH   NUMBER
        (cm)         (cm)          (cm)

 0+      0.0          9.9           8.5          3

Enter the maximum age 1+ cm length:
```

As each age group is defined consecutively, the minimum and maximum length of all younger age

groups are displayed along with the mean length of all individual fish falling within each length interval and the number of fish included with each age-length interval.

Continue entering the maximum centimeter length for each successive age until you've defined your oldest age group. When prompted for the next maximum age, simply press <**Enter**> to signify that you've completed defining groups. When finished you should see a display such as this:

```
AGE   MIN LENGTH   MAX LENGTH   MEAN LENGTH   NUMBER   MEAN WEIGHT   Kn
        (cm)         (cm)          (cm)                   (kg)

 0+      0.0          6.9            -           -         -          -
 1+      7.0         13.9          12.1         27       0.020      101 ±4
 2+     14.0         20.9          18.9        147       0.085      109 ±2
 3+     21.0         27.9          24.4        179       0.196      109 ±2
 4+     28.0         33.9          30.6        156       0.396      104 ±2
 5+     34.0         39.9          37.0        117       0.733      105 ±2
 6+     40.0         44.9          41.9         60       1.082      106 ±2
 7+     45.0         49.9          46.6         20       1.530      109 ±4
 8+     50.0         54.9          51.0          2       2.034      113 ±57
 9+     55.0         59.9            -           -         -          -
10+     60.0         64.9            -           -         -          -
11+     65.0         69.9            -           -         -          -

Enter the age to be edited: 10
Enter the maximum age 10+ cm length: 67
```

Mean weights and LeCren's condition factors are calculated from individually measured fish within each age group. Mean Kn values are accompanied by the 95% confidence interval of the means.

Editing age group definitions

To change the definition of a single pair of consecutive age groups involves reentering the maximum length of the younger group of fish to be redefined. To make this change, enter the age of the younger age group when asked to:

```
Enter the age to be edited:
```

Then reenter the maximum length of this group. The next age group's minimum length will automatically adjust to keep the length interval definitions consecutive. *Length groups may not be set to overlap one another.* Unlike the group definition routine currently within FISHTAB, all other group definitions will be retained, so, reentry of older age groups is not necessary. Once you've made your final change, press <**Enter**> when asked to "Enter the age to be edited:" . This completes the definition of your group file. If editing an age group requires you to set a maximum length that exceeds that maximum length of the next age group, you should restart the group definition process by repeating the GROUP command with your current group filename, rather than attempting to adjust the current age groups. Redefining an age group beyond the maximum

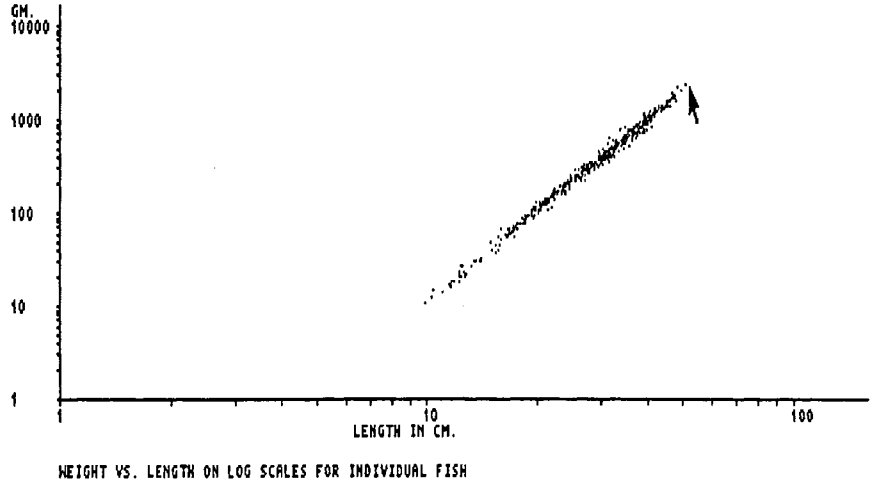
length of the succeeding age group can lead to an erroneous age and graphical output by the program.

To print the resultant AGE table, use the following command:

SEE
SEE displays the currently selected GROUP file in tabular form (i.e., displays the AGE table). To then save this table to a file use the **FILE** command, followed by the **PRINT** command (see the description at the end of this section). To send this table to the printer, simply use the **PRINT** command by itself or **PRINT** followed by a title for the table.

Other Useful Graphics Commands

MOUSE
MOUSE is the equivalent of the **BOX** command from the DOC9 Apple//e Forth Graphics package. **MOUSE** activates the mouse and displays an arrow cursor. The tip of the arrow is then moved by moving the mouse *without pressing either mouse button.* The mouse positions the tip of the cursor to pinpoint the length and weight values of any point on an **L/WT** scatterplot. The primary use of this command is to identify individual length-weight *outlier* records. These values can then be sought out when verifying the length-weight-age records within your FAS-Lakes SCREEN8 table. The mouse remains active until either mouse button is pressed. Pressing either button returns you to standard Forth command line mode.



An example of the **MOUSE** command used with a scatterplot of largemouth bass length-weight data.

TXT
This command is the equivalent of the DOC9 Apple//e Forth Graphics **TEXT** command. **TXT** clears graphics from the screen.

Sending Plots to the Printer or to a File

PRINT
The **PRINT** command sends the current plot to either a file (specified by the **FILE** command) or to the printer specified by either the **LQ** (dot matrix) or **LASER** (postscript) command. **PRINT** assumes that output is to be sent to a dot-matrix printer by default. To include a one-line title with the plot, simply enter your text immediately following the **PRINT** command. For instance, if you wish to add a title to the currently displayed plot, then send that plot to the printer, you would type:
PRINT ***This is a length frequency histogram of LMB from Heidecke Lake - Fall 1996*** <Enter>

The text in italics would appear immediately below the default x-axis labels on the copy of the plot generated by the printer.

If a file has been opened by the **FILE** command, **PRINT** will copy the plot to that file, then close the file, rather than sending the plot to your printer. However, the next **PRINT** command will return to sending output to the printer until another **FILE** command is issued.

FILE ***filename***
FILE creates a file (designated by the ***filename*** entered immediately following the command) for saving a *single* plot to disk. This command can be used for any postscript graphics (i.e., graphs created after issuing the **LASER** command) or for any text displays (such as the age group table created by the **GROUP** command). This command, however, will not properly save graphs which are normally sent to a dot matrix printer. *Therefore, use this command judiciously*. Only one plot may be saved per file. A plot is saved to the designated file using the **PRINT** command.

FISHTAB - FAS DATA ANALYSIS AND TABULAR OUTPUT PROGRAM

INTRODUCTION

The program, FISHTAB, is the primary tool for calculating basic fisheries statistics, creating summary tables, and exporting text files of aggregated data from the FAS database. FISHTAB will ultimately be able to accept input data from either the FAS - Lakes or FAS - Streams fisheries databases. Input to the program is in the form of an ASCII delimited text file. These data are compiled and exported from Paradox in an automated fashion using the Lake Enter program option **<F>**.

FISHTAB has been written to serve as a comprehensive program, incorporating all of the tabular output programs developed for the DOC9 lakes database of the Apple IIe/General Manager System, during F-46-R and F-69-R (Bayley et al., 1990). The current version of FISHTAB is designed to analyze individual fish samples. When data from a number of lakes and years are exported to FISHTAB, summaries may be created to compare fisheries statistics for a group of sites from a selected year or for a series of years from a single sampling site.

FISHTAB consists of four tabular output modules:

1. Species presence table.
2. Length-frequency table and condition index table.
3. Catch per unit effort (CPUE) tables.
4. Stock index table.

The reports generated by these modules are as follows:

Length-frequency/Condition creates individual species summaries of total abundance, mean weight, and average condition by relative weight (Wr) and LeCren's (Kn) condition indices listed by fish length intervals as defined by the user. Length Frequency/Condition tables may be created for as many fish species as are included in the data set being analyzed. The 95% confidence interval of each mean condition index is also reported.

Catch Per Unit Effort (CPUE) produces two sets of tables summarizing data on catch and effort. Catch is summarized by species, subdivided into evenly sized or user-defined length intervals, and separately reported in terms of numbers and weight of fish collected. Length and weight are displayed in metric and in English units. The first CPUE option displays CPUE by frequency while the second reports CPUE by biomass. If no gear is selected, the outputs show mean values for each sample station and gear (i.e., 1E, 1G, 1T, etc.) for each fish species collected. If a single gear is selected, the output is presented for each individual sample (1E1, 1E2, 1G1). When you run CPUE with a species selected, CPUE is displayed for each individual sample by user-defined fish length categories.

Species Presence examines the entire selected data set and generates a species list accompanied by

the total frequency of each species collected, with total frequency corrected for subsampling. This module is typically the first one selected in exploratory data analysis and is very useful in determining which species in a given data set deserve detailed analysis.

Stock Index calculates the proportional stock density (PSD), young-to-adult ratio (YAR), and up to three relative stock density (RSD) indices for individual species. Whenever available, minimum values for species stock and quality sizes have been integrated into the program and are used automatically in calculating PSD. For species lacking these values in FISHTAB, lengths for stock and quality size are input by the user.

Output tables created by each module are displayed on screen by default; however, each may also be printed or saved as a DOS text file. All results are given in metric and English units wherever appropriate.

FISHTAB has been developed as a DOS stand-alone analysis program using the programming language C (Watcom C/C++[32] Optimizing Compiler and Tools, v 9.5, Watcom International Corp., Waterloo, Ont.). There are several advantages to this approach. First, by developing this program in a standard programming language, rather than in PAL (Paradox Application Language), the need to have the data resident in a Paradox database is avoided. Fisheries data from other sources can be analyzed by FISHTAB as long as they are in the form of a DOS text file and data records match the input structure required by the program (see pp.56-57). Development in C eliminates the need and expense of rewriting FISHTAB, if an alternative database package is chosen for FAS-Lakes & Streams. Finally, coding in C allows FISHTAB to be use on either PC or Macintosh systems.

FORMAT OF FISHTAB INPUT FILE - TEMP.TAB

The data used for analysis by FISHTAB is contained in a comma-delimited, ASCII text file known as TEMP.TAB (formerly LFREQ.TXT). This format has been chosen because all spreadsheet, database, and statistical packages currently in use by IDNR will easily export and import data in this manner. TEMP.TAB is comprised of fish length frequency and associated data records. Each record of this file is unique for a specific combination of fish species and length interval (either as a 1-mm or 1-cm size interval) - collection (gear and run/set) - and collection event (site and date). These length frequency data are accompanied by:

-an estimate of the total biomass of the fish tallied in the record,
-the average condition of these fish (measured by Kn and Wr),
-the variability of these averages (given by the sum of squares
of the condition index value of individually weighed fish),
-the estimated total abundance of fish of this species/length interval
after the sampled total frequency is corrected for any sub-sampling, and
-the duration of the sampling (in minutes).

The table below shows the FAS-Lakes database **Field Names** listed in uppercase in the left column. The middle column, **Field Type** displays the Paradox field definition with "A" = character data, # = number of characters; "N" = numeric data; "S" = short integer data. The right column, **Description**, is a brief narrative associated with each Field Name. FISHTAB requires each fish length frequency record to be organized in the following manner:

Field Name	Field Type	Description
ID	A13	13-character unique sample code - composed of the 5 digit IDNR-Fisheries Water number, 4 digit year of sample, 2 digit season-trip code, and 1 digit station number (e.g. 00091.1995311 for Clinton Lake - Fall 1995 - Sampling Trip #1 - Station 1).
LAKE	A30	Actual name of lake sampled.
SAMPLE	A2	Two character Gear-Run or Set Number code (e.g. E1 = AC Boat Electrofishing Run #1).
FASSP	A3	Three-letter FAS Species code (e.g., BLG for Bluegill).
TLCM	S	1-cm fish length interval (expressed as millimeters)
FREQ	S	Number of fish collected during sampling run/set.
EFFORT	S	Duration of sampling run/set (expressed in minutes).
NTOT	S	Total number of fish collected during entire sampling run/set corrected for subsampling.
BIOMASS	N	Estimated total weight (g) of NTOT fish, based on the sum of fish individually weighed plus the sum of estimated weights (based on the species' standard length:weight relationship) of non-weighed fish included in the total fish count.
WT	N	Sum of the actual weights (g) of individually measured fish.

NWT	S	Number of fish individually weighed.
KN	N	Mean LeCren's Condition Index, Kn, of individually measured fish.
KNSQ	N	The sum of Kn's for individually measured fish squared
WR	N	Mean Relative Weight Condition Index, Wr, of individually measured fish.
WRSQ	N	The sum of Wr's for individually measured fish squared.

Sample records from TEMP.TAB:

"00091.1985311","CLINTON LAKE","E1","BLB",200,1,30,1,117,117,1,.6840966343928,.4679882051876,

"00091.1985311","CLINTON LAKE","E1","BLG",110,5,30,20,524.8703375931,22,1, .8275430256489, .6848274593001, 78.65657742722,6186.857172565

RUNNING THE FISHTAB PROGRAM

FISHTAB will run from DOS or Windows, however running FISHTAB under DOS is recommended for older 386 and 486 machines, for faster start-up and processing times.

In the following instructions, the information required to be typed in by the user will be in upper case bold-face. Required information which may change from user to user (e.g. a drive designation) will be italicized. Keys will be denoted by < > (e.g.,**<Enter>**)

To invoke the program in a DOS environment:

1. Change to the NEWFAS directory by typing in the following command at either the C:\> or D:\> prompt.

TYPE: **CD** *drive*:**\NEWFAS** and press **<Enter>**

where *drive* = the appropriate hard drive partition for NEWFAS (e.g. C:\NEWFAS). Example: C:\>**CD C:\NEWFAS**

2. At the prompt you can activate FISHTAB with the following command:

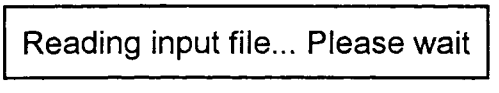
Type: **FISHTAB** and press **<Enter>**

Example: C:\NEWFAS>**FISHTAB <Enter>**

As FISHTAB begins, the following prompt will appear:

Enter the input filename (no extension):

At this prompt, simply type in the first part of the filename you created through the Data entry program. If no name is entered, FISHTAB will use the default file TEMP.TAB. **Note: You must have an input data file for FISHTAB to run.** As the data file is loaded into memory, you will see the following message displayed:



Depending on the speed of your PC and the size of the data file, this may occur quickly or take as long as a minute or more to complete. For a PC with a 486 processor, running at 66 MHZ, an INPUT.TXT file of 1173 records will load into memory in three seconds. For slower machines, especially 286 or 386 PCS, the initial data upload will take longer.

Using FISHTAB from Windows

Creating an icon for FISHTAB

Although FISHTAB is a DOS program, it can be accessed from Windows with an icon. To do this, you will need to create a **Windows Program Item** for FISHTAB. To establish an icon first:

1. Decide where the FISHTAB program icon will reside. You can create a brand new **Windows Program Group** for it, or put it in the existing program group. An example of a **Windows Program Group** is the Main Group, whereas a **Windows Program Item** is File Manager. For the following FISHTAB example, the icon is placed in the existing program group, FAS PROGRAMS - the same program group that contains the icon for the data entry program.

2. Once the program group has been selected, **double-click** on it to either open it, or if already open, to make it active.

3. Click on the **<File>** menu item in the upper left-hand corner of the **Windows Program Manager.**

4. Select the **<New>** option from the resulting drop down menu.

5. Be sure the **Program Item** button is selected and click on **<OK>** in the resulting **New Program Object** window. The **Program Item Properties** window will appear.

6. In the Description Box, type the name of the Program. Type:

   FISHTAB

   In the Command Line box, type:

   C:\NEWFAS\FISHTAB.EXE

This last step assumes that your FISHTAB program executable file, FISHTAB.EXE, has been placed in the C:\NEWFAS directory. If it has been placed elsewhere, be sure to specify the full path to the directory where the program resides along with its name and three letter extension (EXE). As an option to typing all of this in the command line box, the BROWSE button can be used to point and click your way to the FISHTAB.EXE file.

In the Working Directory box type:

C:\NEWFAS

or the appropriate path if different from this one.

7. Finally, you must select an icon. Since no icon exists specifically for FISHTAB, you may use any of the icons provided with Windows. To do this, simply click on the Select Icon button and use the arrow keys to display the wide selection of icons. Click on the icon of your choice.

8. Click on the OK button to finish the process. A new icon labeled FISHTAB will appear in the FAS PROGRAMS program group. To run FISHTAB, as with any program in Windows, simply double click on the new icon.

FISHTAB MAIN MENU

Once TEMP.TAB has been completely loaded into memory, the main menu is displayed and shows thirteen FISHTAB options. Enter the letters or number corresponding to the menu item that you wish to invoke and press <**Enter**>. The letter menu items may be typed in either in UPPER or lowercase. The menu display is as follows:

```
FISHTAB Main Menu

N    Next trip.        Current: 1984(31) HEIDECKE LAKE.
P    Prior trip.       48 trips selected

L    Select lake.
Y    Select year.
S    Select current trip.
G    Select gear.
SP   Select species.

1    Length-frequency/Condition.
2    Catch frequency per unit effort.
3    Catch biomass  per unit effort.
4    Calculate PSD.

F    Divert printer output to a file.
BYE  Exit the program.

Your choice? L
```

Note that the **data analysis modules** are invoked by typing a **number, 1-4**, whereas the **data set selection criteria, printing to a file and exiting the program** are selected by **typing a letter**. Before any of the data analysis modules, (i.e., options 1-4), can be run, **L**ake, **Y**ear and **SP**ecies parameters need to be selected using menu items <**L**>, <**Y**> and <**SP**>. Optionally, **G**ear can also be selected with menu item <**G**>. <**S**> specifies a **single sample trip** for analysis and selects the trip shown as "**current**". These items are used to further define the data set to be analyzed.

Also note that menu items <**N**> **(next)** and <**P**> **(previous)** can be used to sequentially move to the next and previous sample-trips contained in TEMP.TAB file. This is analogous to moving through data sheets in a file folder. When the program first starts, the year, season and name of the first lake in the TEMP.TAB file are displayed adjacent to the option <**N**> item. The number of sample-trips currently selected is displayed adjacent to the <**P**> menu item. By default, this is all the sample trips selected when you created TEMP.TAB. As menu items <**L**>, <**Y**>, <**G**> and <**SP**> are used to

further narrow down and define the data set to be analyzed, the sample-trips selected value changes to reflect the current status of the given selection, as illustrated in the following three examples (the main menu display in these examples has been truncated for emphasis) :

In the above example, the first record of the TEMP.TAB file is listed as the current record, and since no other criteria have been specified via the <L>, <Y>, <S>, <G> or <SP> menu items, the sample-trips selected value reflects 48 sample id's (i.e., all the records in the sample input file).

Next we use option <L> to define a specific **Lake** from the TEMP.TAB file and since this lake has a total of eight years worth of data we see the following:

```
FISHTAB Main Menu

 N   Next sample-trip.    Current: 1984(31) HEIDECKE LAKE.
 P   Prior sample-trip.   9 trips selected

 L   Select lake.         HEIDECKE LAKE
 Y   Select year.
 S   Select current trip.
 G   Select gear.
SP   Select species.
```

In the next example, the <Y> menu option is used to further narrow down the data set. Note that once year is specified as 1987, only two sample-trips are reported as being selected - spring and fall. The fall trip would be displayed as current record if menu item <N> were invoked to cycle to the next selected record. To specify either the spring or fall sample, you would use the **N** or **P** commands until the trip was displayed as the current trip. Then use <S>, **"Select Current Trip"** to select the trip. The number of sample-trips will change to 1.

```
FISHTAB Main Menu

 N   Next sample-trip.    Current: 1987(11) HEIDECKE LAKE.
 P   Prior sample-trip.   2 sample-trips selected

 L   Select lake.         HEIDECKE LAKE
 Y   Select year.         1987
 S   Select current trip.
 G   Select gear.
SP   Select species.
```

PROGRAM OPERATION

Note: All menu selections and answers to questions asked by FISHTAB must be entered from the keyboard. Mouse input is not recognized by the program. Answers may be typed either in upper or lower case. Incorrect entries will be trapped automatically by the program. Illegal responses should simply cause the program to repeat the prompt for user input, rather than cause FISHTAB to fail or end prematurely. Finally, the last option used is set as the default option for: **Your CHOICE?**. Therefore, if you are repeating an option of the main menu, simply press **<Enter>** , rather than retyping the option number or letter.

FISHTAB Data Input

For FISHTAB to run successfully with FAS-Lakes data, the data input file must meet two criteria. First, all fish length-frequency data passed into FISHTAB must match the format given in table on pages 55-56. FISHTAB will accept records with incomplete data as long as each missing value (with the exception of the last field, WRSQ) is accounted for by a comma delimiter (e.g. *2,"1ES",1987,"BLD","M",77,1,1,4.71,1,,,,*). The second requirement is that the data file exported from Paradox must be a comma-delimited, ASCII text file.The default name for this file is **TEMP.TAB**. However, FISHTAB will accept input from any data file with an extension .TAB (filename.TAB) , as long as it has the appropriate data fields and structure.

The general method of Paradox database querying is used to construct a temporary ANSWER table, which can then be exported as a TEMP.TAB file. In particular, the query process in Paradox main menu item "ASK" is used to set the selection criteria for fish data. Although this process isn't difficult within Paradox, it is critical that data are consistently exported in the correct format. To insure this and to make the data selection/export procedure more user friendly, a Paradox script which automates the creation of TEMP.TAB has been developed and is incorporated in the data entry program's main menu as option **<F> - Generate a FISHTAB input file**. Finally, while FISHTAB should be capable of analyzing a data file with numerous sites, years, and fish species, the program will work most efficiently with discrete sets of data, such as multiple years for a single lake or multiple lakes for a single year.

In order to generate a FISHTAB input file, using the Paradox script mentioned above, start the FAS data entry program. You will be presented with the following menu:

```
Illinois Statewide Lake Fishes Database. Sample_

L       Select lake
Y       Select year
S       Select sample
SP      Select species
SL      Species list

N       Enter station, depth, and gear data for a new sample
LF      Enter length-frequency data
LWA     Enter length-weight-age data

F       Generate a FISHTAB input file
G       Graph selected data
P       Paradox menu
HELP    View further instructions
BYE     Leave Paradox

Type in your selection and press Enter:
```

Now you need to decide how you wish to analyze your data. The following options are available:

1. Single lake for a single year.
2. Multiple years for a single lake.
3. Multiple lakes for a single year.
4. Multiple lakes for multiple years

Single lake for a single year

Selecting a Lake

This is the simplest and fastest of the above options. Specify a lake by typing <**L**> at the main menu prompt and then type in the lake name, or select the lake name from the Paradox table (WATER95.db) as described earlier in the data entry portion of this manual (p. 13-15).

Selecting a Year

Once a lake has been selected, the next step is to select a year. Type <**Y**> at the prompt: **Type in your selection and press Enter:**. Then press <**Enter**> and type the desired year at the resulting prompt: **What is the year?**. Then press the <**Enter**> key. Note that the year can be typed as either four or two digit number, i.e., 1992 or 92.

Once the lake and the year have been selected, type <**F**> at the prompt and press <**Enter**>. This brings up the Secondary Selection Menu. See the discussion associated with this menu on pages 31-

34 for specifics on the various options available at this point. Essentially, to create the file (TEMP.TAB) containing the sampling data for the selected lake and year, press <**Enter**> one more time. The input file for the FISHTAB program is created and the program itself is started.

Multiple years for a single lake
To analyze multiple years for a single lake, select the desired lake without selecting any year. Next, select option <**F**> followed by pressing <**Enter**> twice. The sampling data for all the years in the database that are associated with the selected lake will be included in the resultant TEMP.TAB file. Note that with larger data sets it may take a while for the query to be processed, so some patience may be required. NOTE: The creation of TEMP.TAB is complete when the FISHTAB program main menu appears.

Multiple lakes for a single year
This scenario is almost identical to the one above, except that in this case you should select the desired year without making any lake selections before invoking option <**F**>. All the lakes in the database that have sampling data for the selected year will be included in the resultant TEMP.TAB file.

Multiple lakes for multiple years (exporting the entire database)
Although it is possible to create a TEMP.TAB file with multiple lakes whose data spans multiple years, this option is not recommended for historical district data sets because, depending on the size of the data set and the processor speed of the machine being used, it would take an inordinate amount of time - it is equivalent to duplicating the entire data set, rather than selecting a subset as in the above three options. For those who wish to ignore this recommendation, simply invoke the <**F**> menu item without making any lake and/or year selections, to generate your TEMP.TAB file.

After you have defined a data set, you can then run the analysis program, FISHTAB. Note that the TEMP.TAB file is saved to the same directory as LAKENTER.SC.

Option F - Divert printer output to a file
This allows you to designate an ASCII text file for storing any tabular output created and displayed within the four output modules. The contents of this file is simply a dump of the table screen display. This file can be imported into word processors or other packages for further processing. However, this file is delimited by spaces and is best viewed using a constant width font such as courier. When selected, FISHTAB will ask you to enter a filename. The name must comply with DOS standards (i.e., not greater than eight characters long, with an optional extension no more than three characters). Once opened from any module, output tables will be written to this file whenever you chose the "Print table" option, rather than being sent to your printer. Note that by default, when you choose to "Print the table" in any of the modules, FISHTAB will send the output to your printer, until you select Option **F** from the main program menu or one of the module menus.

If, while running FISHTAB, you wish to stop saving tables to the output file, select Option <**F**> and press the <**Enter**> key. This redirects any further printing back to the default destination of your printer. This is done from the FISHTAB main menu. Once you've chosen to stop diverting tabular

output to a file, the file is closed. FISHTAB cannot add additional output tables to those already present in the file. If you choose to divert printer output to an already existing file, FISHTAB will display a message WARNING that the file already exists. If you decide to write to that filename, FISHTAB will proceed to overwrite the existing contents of the file.

If you wish to divert output to a file other than to the one currently open, select Option **F** from any of the modules and enter the name of the new output file. This will automatically close your current output file, saving it to the DOS directory in which you are currently working, then create the new output file. FISHTAB will automatically save any output file that you're currently writing to, whenever you choose to exit the program.

LENGTH - FREQUENCY/CONDITION INDEX TABLE

Before you can generate a Length-frequency/Condition index table, you need to select a lake, year and species from the FISHTAB program main menu. Gear can also be selected. If no gear is selected, the program will look at fish caught by all the gears associated with the given lake/year/season combination. When a given lake/year combination has more than one sampling season associated with it, only one season at a time should be analyzed. The reason for this is that FISHTAB uses all of your selected data and will pool data unless you specify a single sampling trip. Unlike gear codes, seasons can't be lumped together. The year, season and lake currently selected are displayed on the first line of the FISHTAB main menu beside the <N> **Next trip** menu item. If you want to analyze data for a season other than the one currently selected, you can do so by scrolling through the available data using the **<N>-Next Trip** and **<P>-Prior Trip** commands. When the desired sample is shown as the current sample you can select it by using the <S> command. The selected season code will be displayed both, on the first line of the menu and beside the **<S>-Select current trip** menu item. To deselect an item simply enter the command for the item and press **<Enter>**, when you are requested to make a selection. Once all the desired variables describing the data set to be analyzed have been defined, start the Length - frequency/Condition program module by typing <1> at the prompt: **Your choice?** and press **<Enter>**. You will see the following menu:

```
A) Groups of 1 cm.
B) Groups of multiples of 1 cm.
C) Choose your own groups.
D) Load a file of previously saved groups.
Your choice? A
```

Choose the option that you want and press **<Enter>**. Each option is described below.

Even intervals (Options A and B):
Choosing either option <A> or <B> will automatically generate a table summarizing data by evenly spaced length intervals. After choosing either of these options, you will be prompted to enter the minimum length (in millimeters) for the initial length interval (the smallest sized fish). If Option **<B>** is chosen, the program will first ask you for the size (in centimeters) defining the length interval that you wish to use for all intervals (the default used in Option <A> is 10 mm). Enter an integer value greater than 1. This represents the number of centimeters used to define the groupings. For either option, the program automatically sets the largest interval size displayed in tabular output as equal to 10 mm longer than the largest length for that species found in the entire data set. FISHTAB automatically creates consecutive length intervals, starting with the minimum length that you've entered, through the length interval with the longest fish (e.g. 0-5 cm, 5-10, 10-15, 15-20, ...,95-100). All length intervals within this size range will be sequentially displayed in the Length-frequency table created by FISHTAB, even if no fish are within a length interval.

Choose your own intervals (Option C):
When you choose option <**C**>, you will be given the option to delineate your own length criteria for grouping fish. You will first be prompted for a minimum length (in millimeters) for the initial length interval. After specifying the desired value, the following prompt will appear:

```
Group  1)   0 -  Enter upper bound or press Enter if last: 0
```

Enter an integer that will represent the upper bound of the first length interval (in millimeters). This number must be larger than the lower bound displayed for the interval. Continue this process until you have defined length intervals for the entire range of sizes that you wish to include in the species analysis. The entry of an upper bound length must be no greater than 9,999 mm.

Once you've entered the maximum length for the first interval, the menu will automatically display the minimum length of the next new length interval, setting it equal to the upper size of the preceding interval. This will continue until you press <**Enter**> to accept the zero default that appears with each new prompt. There do not appear to be any limits on how many groupings can be chosen. Once the last group has been defined, a prompt will ask whether or not you desire to make changes to any of the groups. If no changes are desired, press <**Enter**> to proceed. If you wish to edit a group, enter it's number at the prompt and press <**Enter**>. The menu will delete all groups beyond the one you specified (i.e., the intervals for longer fish) and ask you to enter a new upper bound for the group that you have chosen. You must then reenter the remaining length intervals.

Once you are done defining the length intervals for the analysis, a prompt will appear asking if these length intervals should be saved to a file. If not, press <**Enter**> to accept the default negative response. If you wish to save to a file, type <**Y**>, press <**Enter**>, type in a file name at the resulting prompt and press <**Enter**> again. A Length-frequency/Condition table is displayed showing the specified groupings. Be sure to remember the name of the file to which the grouping scheme was saved, if you wish to use this scheme at a later time without having to redefine it again. This file is saved to the C:\NEWFAS directory, or to whichever directory you've installed the FISHTAB program. The information is saved as an ASCII text file.

Load intervals from a file (Option D):
When you opt to load a file of previously saved intervals, you will be prompted for the name of the file containing the intervals. If FISHTAB fails to find the file, it will ask you if you wish to try again. If you don't, it will automatically switch you to the **Choose your own intervals** option.

An advantage of saving interval definitions to a file is that this will allow you to standardize the length intervals used for all analyses of a particular species. This also takes advantage of the convenience of having FISHTAB load and use this set of length intervals whenever Length-frequency/Condition or CPUE is run for this or any other species that you choose, thereby saving you the effort of retyping

length interval definitions. NOTE: You will not be given the option of saving your length groupings to a file if you've loaded them from a file.

Use the same intervals as before (Option E):
This option appears only after examining the first species. Choosing Option <**E**> allows you to use the same set of length intervals and lower bound of the first interval that were just used for the most recent Length-frequency/Condition table.

Display Of Length Frequency/Condition Index Tables
After length intervals have been selected, the program proceeds to summarize the data as requested. The results are then displayed in tabular form. For the lake, year, and species currently selected, the entire set of length intervals that you have designated will be displayed. Each length interval is accompanied by: the number of fish collected within the size range; the average weight of these fish, in grams and pounds; the number of individual fish weighed; and the mean condition factor index (as Wr and Kn) of weighed fish. The table, when printed, should appear in this form:

```
LMB 1984(31) HEIDECKE LAKE.      LENGTH FREQUENCY/CONDITION INDEX
-------------------------------------------------------------------------------
        LENGTH GROUP          TOTAL    MEAN WEIGHT     NO.       MEAN CONDITION
       MM        INCHES      L-FREQ    GRAMS   LBS  WEIGHED  WR (95%)   KN (95%)
-------------------------------------------------------------------------------
   0 - 99     0.0 - 3.9        43       5.6   0.01     12     80 (  19) 0.76 ( 0.2)
 100 - 199    3.9 - 7.9       102      31.5   0.07     75    108 (   2) 1.05 ( 0.0)
 200 - 299    7.9 - 11.8       17     211.9   0.47     14    109 (   5) 1.10 ( 0.0)
 300 - 399   11.8 - 15.7       18     635.6   1.40     18     98 (   5) 1.01 ( 0.0)
 400 - 499   15.7 - 19.7       20    1359.5   3.00     17    100 (   6) 1.06 ( 0.1)
 500 - 599   19.7 - 23.6        1    2490.0   5.49      1    105     -   1.11     -
             TOTALS:          201                       137

Part 1 of 1 Press Enter to continue, P to print, arrow and page keys to
browse:
```

The number in parentheses under the Mean Condition (95%) column is the 95% confidence limit of the mean condition value displayed immediately to the left. Adding or subtracting this number from its associated mean Wr or Kn value will give you the 95% upper and lower confidence limits for the mean.

The Length-frequency/Condition table usually has to be displayed on the screen in several parts, because displays are limited to only eighteen length intervals at a time. For tables spanning several screen displays, press the <↑> or <↓> keys, or <**Page Up**> or <**Page Down**> key to proceed to the next screen preview.

At any point in the display you are presented with two options: <**Enter**> **to continue, P to print**. Pressing <**Enter**> returns you to FISHTAB main menu. If you choose **P**, and you are not diverting this output to a file, a printout of the currently displayed table will be created. Make sure the printer is connected and turned "ON" prior to using this option. You will be given the option of entering a one

line table description, to be printed at the top of the page. If you wish to skip this step, press **<Enter>** and printing will begin.

CPUE TABLES

Option **2-Catch frequency per unit effort** and Option **3-Catch biomass per unit effort** of the FISHTAB Main Menu, are designed to generate a table summarizing catch as numbers and weight of fish for individual species for selected sets of fish sample ID's. The measure of effort is dependent upon the collection method. Sampling by electrofishing (boat-mounted and backpack) is reported as catch per hour. Standard seining is reported as catch per haul, while the catch by passive gears such as gill, trap and trammel nets are reported as number or weight per night set. Catch by rotenone is expressed as per area sampled. The catch values on which CPUE bases its analyses, found in fields NTOT and WT (Table C-1), are scaled for these effort units prior to being exported from Paradox to the TEMP.TAB file.

Like the Length-frequency/Condition module, CPUE has been written to organize data analyses from either a temporal (multiple years for a chosen site) or a spatial (multiple sites for a chosen year) perspective. For each sample ID (site and date) included in an analysis, you select the species to be analyzed and the length intervals for each species, using the same steps as for Length-frequency/Condition. Calculations are made in a manner similar to those described in Bayley, et al. (1990). However, an important difference between this program and early versions written for analyzing lake fisheries data on the Apple IIe is that CPUE data are log-transformed for analysis. Means and upper and lower confidence limits are then converted back to original units for display. This statistical procedure is more appropriate method for analyzing positively skewed data distributions, which are the norm for these types of data. This approach also prevents confidence intervals from including negative values.

To generate either of the two available catch frequency tables you must select parameters for lake, year, sample and species from the FISHTAB main menu. This can be done in either of two ways.

1. Use the **<N>** or the **<P>** commands to move through your TEMP.TAB file until you find the sample of interest. Then select the sample using the **S** option. This will fill in the parameters for lake, year, and current trip. If you want to select a **gear** and **species,** you can do this now using the **<G>** and **<SP>** commands.
2. Alternatively, you can use the **<L>** and **<Y>** options individually to select **lake** and **year**. Again, you also will need to enter gear and species codes

Once the above variables have been defined, simply invoke the desired catch frequency program module by typing its menu number, **<2>** or **<3>**, at the prompt: **Your choice?** and press **<Enter>**.

CPUE Table Options:

With the CPUE biomass or numerical output table, four options are available for display of the data. These options include: (1) all species in the selected data set, summarized for each station and gear used (3) a single species with the option of establishing custom length groups, (3) by gear type (e.g., E, G, T), or (4) by individual sample (1E1, 1E2, etc.). In all cases, the format of the output is determined by selection upon a species code or a gear code. If a species is selected for CPUE output, you will be given the option of establishing length groups, as in the length-frequency condition table.

A typical output might look like the following Heidecke Lake largemouth bass data, for electrofishing samples. Note that 10 cm length groups were chosen for the output:

```
Heidecke Lake, 1991, largemouth bass
Page 1 of 1

1984(31) HEIDECKE LAKE.  LMB CPUE in number of fish per hour or set.
-------------------------------------------------------------------------
--------
MILLIMETERS INCHES       1E       1G       2E       2G       3E       3G

-------------------------------------------------------------------------
--------
  0-99     0.0-3.9       8.4        -     10.0        -      7.0        -
100-199    3.9-7.9      16.2      0.3     29.3        -     19.0        -
200-299    7.9-11.8      5.4        -      1.3        -      2.0        -
300-399   11.8-15.7      3.0        -      4.0        -      5.0        -
```

Remember, that if you wish to redirect the resulting table(s) to a file for later import into a wordprocessing or spreadsheet software package, use main menu item **<F>** to define the file that will be receiving the table. Once the table is generated, use the **<P>** or **<A>** options that appear in a menu at the bottom of the table, to copy the table to the file.

If you select a gear (e.g., E or G), but no species, you will be presented with a CPUE table showing all species in the selected data set by sample (e.g., 1E1, 1E2, etc.). A sample output from the **Catch frequency per unit effort** program module is shown below:

1984(31) HEIDECKE LAKE. GEAR E CPUE in number of fish per hour or set.

SPC	1E1	1E2	1E3	1E4	1E5	2E1	2E2	2E3
BLG	320.0	186.0	124.0	96.0	81.0	200.0	430.0	300.0
BLT	2.0	-	-	-	-	-	-	-
BNS	-	-	-	-	3.0	-	-	-
BRS	10.0	24.0	38.0	26.0	3.0	122.0	12.0	18.0
BUM	-	-	-	-	3.0	-	-	-
CAP	2.0	8.0	10.0	6.0	33.0	10.0	8.0	2.0
CCF	-	-	-	-	-	-	-	-
EMS	2.0	-	-	-	3.0	-	-	-
FRD	-	4.0	4.0	-	30.0	-	-	-
GOF	-	4.0	2.0	-	-	-	-	-
GSF	12.0	12.0	2.0	2.0	-	18.0	8.0	8.0
GZS	306.0	286.0	1006.0	504.0	1641.0	130.0	252.0	116.0
LMB	54.0	36.0	26.0	34.0	30.0	42.0	46.0	50.0
LOP	-	-	4.0	4.0	6.0	-	2.0	-
PUD	2.0	-	-	-	-	-	-	-
RES	-	-	-	-	3.0	-	-	-
RSF	4.0	-	-	-	-	-	-	2.0
SMB	-	-	2.0	4.0	-	6.0	4.0	6.0
THS	-	-	2.0	-	-	-	-	4.0
YEB	10.0	4.0	6.0	4.0	6.0	2.0	8.0	10.0
YLB	-	-	-	2.0	-	-	-	-

Part 1 of 2 Press Enter to continue, P to print, arrow and page keys to browse:

CPUE option **2**, when gear is selected. In the above example, gear is set to "E." Note that just as the up and down cursor keys can be used to scroll up and down the table, so the left and right cursor keys can be used to scroll left and right in the table in case the table doesn't fit on the screen.

A sample output from the **Catch biomass per unit effort** program module is shown below:

1984(31) HEIDECKE LAKE. GEAR E CPUE in kg (and pounds) per hour or set.

SPC	1E1	1E2	1E3	1E4	1E5	2E1	2E2	2E3
BLG	6.426 (14.197)	3.679 (8.128)	3.905 (8.629)	2.452 (5.418)	2.509 (5.544)	4.271 (9.436)	9.712 (21.458)	5.514 (12.184)
BLT	0.004 (0.009)	-	-	-	-	-	-	-
BNS	-	-	-	-	-	0.000 (0.000)	-	-
BRS	0.008 (0.017)	0.020 (0.044)	0.035 (0.077)	0.024 (0.054)	0.002 (0.005)	0.138 (0.305)	0.012 (0.027)	0.020 (0.044)
BUM	-	-	-	-	-	0.000 (0.000)	-	-
CAP	2.010 (4.441)	7.358 (16.258)	8.092 (17.879)	5.830 (12.881)	22.062 (48.746)	9.736 (21.512)	7.151 (15.800)	1.730 (3.822)
CCF	-	-	-	-	-	-	-	-

Part 1 of 2 Press Enter to continue, P to print, arrow and page keys to browse:

CPUE option **3**, with gear selected.

Finally, if you are selected on both gear and species you will get an output

1984(31) HEIDECKE LAKE. GEAR E LMB CPUE in kg (and pounds) per hour or set.

MILLIMETERS	INCHES	1E1	1E2	1E3	1E4	1E5	2E1
0-99	0.0-3.9	0.142 (0.313)	0.104 (0.230)	-	0.074 (0.163)	-	0.049 (0.107)
100-199	3.9-7.9	0.571 (1.262)	0.480 (1.061)	0.470 (1.038)	0.326 (0.720)	0.445 (0.984)	0.626 (1.383)
200-299	7.9-11.8	1.090 (2.408)	-	1.760 (3.889)	1.974 (4.362)	0.681 (1.505)	-

SPECIES PRESENCE TABLE

When you choose option *SP) Select species* from the main menu, FISHTAB will search through the program input file, either TEMP.TAB or one you have specified, and generate a species list for the selected lake/year (and optionally gear/season code) combination. As with the other modules, species are listed by a three-letter FAS species code. The Species Presence module also tallies the total number of individuals of each species collected (the sample abundance corrected for subsampling). This total species abundance is reported directly to the right of the species code.

The Species Presence table is designed primarily as an exploratory tool, used for scanning the data set and assisting you in making reasonable selections for analysis by the other program modules. This is generally the first module that you should run when analyzing a new data set.

An example of a Species Presence table for a single lake/year is given below:

```
1984(31) HEIDECKE LAKE.  GEAR E   SPECIES FREQUENCY ADJUSTED FOR SUBSAMPLING
-------------------------------------------------------------------------------
BLG 1047    BLT 1      BNS 1      BRS 145    BUM 1      CAP 40     CCF 8
EMS 4       FRD 17     GOF 4      GSF 33     GZS 1983   LMB 200    LOP 7
PUD 1       RES 1      RSF 3      SMB 17     THS 4      YEB 35     YLB 3

Total frequency: 3555.

Enter P to print or species code selection:
```

After viewing the species presence table, the *Enter P to print or species code selection:* prompt offers you an opportunity to select a species code for use with the FISHTAB program modules, such as Length - frequency/Condition. To do so, just type in the three letter code and press <Enter>. As before, if you choose P, and you are not diverting this output to a file, a printout of the currently displayed table will be created. You will be given an opportunity to enter a one line table title at the prompt, *"Table Title:"* Once the species is selected or table printed, the program returns you to the FISHTAB main menu.

STOCK INDEX TABLE

The fourth output module of FISHTAB's main menu is the option *4) Calculate PSD*. This module calculates the proportional stocking density (PSD), young-to-adult ratio (YAR), and up to three relative stock density (RSD) indices and displays these as a table for the selected species. Stock structure indices are calculated using the formulae described by Anderson and Gutreuter (1976). Proposed maximum lengths for minimum stock and quality sizes for 23 species of fish (Gabelhouse, 1984) have been encoded into FISHTAB and are used by default in calculating PSD indices for these species. These values are listed in Table C-2. For all other species, FISHTAB will require you to enter a value for stock size and quality size.

Selecting Criteria for Output

You must be selected on species and lake before attempting to produce a table by choosing option *4) Calculate PSD*. The stock index table allows you to examine the data in several manners, but note that only a single site and species is analyzed at a time:

(1) multiple years.
(2) for a specific year with no other selection specified (pools data over all samples and gears).
(3) for a specific sample with no gear specified (pools data over all gears).
(4) for a specific gear with no sample specified (pools data over all samples).
(5) for a specific sample and gear combination.
(6) for a specific year, sample and gear.

However, note that you cannot produce multiple sites for a given year.

To obtain year, sample, or gear stock index outputs you need to select specific year, sample and gear codes from the Fishtab main menu. Remember that you must select a lake and species for the Stock Index table to be functional. If you do not select upon a sample or gear, the program pools all data for all samples or gears in that particular lake, year, species combination. For example, if you have a lake where gears used are E, G, and T and there are spring (11) and fall (31) samples, you have several options. If you leave the gear selection blank, data from all gears will be pooled together in calculating the stock indices. Conversely, if you select just electrofishing (E) the data for gill net and trap net catches will be ignored. If you select a sample (e.g., fall - 31) than the spring sample data is ignored. Conversely, if no season-trip is selected, the program will pool together data from all seasons for the particular year of the data set with which you are working.

Stock Index Menu - Calculating PSD, RSDs, and YAR for a selected species

Upon choosing the *Calculate PSD* option of FISHTAB the program will check to see if stock and quality sizes have been established for the species that you have specified. If available they will automatically be used and you will be asked to enter up to three lengths for RSD calculation as well as the YAR length. If stock and quality sizes are not available, you will be asked to enter stock size, quality size, up to 3 lengths to define RSD groups, and YAR size (all must be input in centimeters). Supply the appropriate numbers and press <Enter> to have FISHTAB accept your entry. To analyze the data for fewer than three RSD's, simply enter 0 and press <ENTER> for the length defining the RSD size. For example, the figure below shows proper entries for calculating RSD's of 40cm, 45cm, and 50 cm and not calculating YAR:

```
Enter the first  RSD in cm or 0 to end: 40
Enter the second RSD in cm or 0 to end: 45
Enter the third  RSD in cm or 0 to end: 50
Enter the YAR length in cm or 0 to end: 0
```

The program will then perform the necessary calculations and display the requested data. You are then given the option of printing this data or continuing on. If you've chosen to analyze the data set for a single site, FISHTAB will calculate and display the indices that you've chosen for each year that the species was collected at the site. When analyzing the data set, all fish records are used, regardless of the sampling method used.

An example of a Stock Index table for a single site/multiple year analysis of Weldon Springs Lake is shown below:

```
WELDON SPRINGS LAKE.  LMB STOCK INDEX TABLE
-------------------------------------------------------------------------------
--
YEAR   STOCK  N    YAR    (N)   PSD    (N)   RSD1  (N)   RSD2  (N)   RSD3  (N)
       20cm,7.9in  0cm,0.0in   30cm,11.8in 40cm,15.7in 45cm,17.7in 50cm,19.7in
-------------------------------------------------------------------------------
--
1985      194        NA    NA  43.8  (85)   6.2  (12)   1.0   (2)   0.5   (1)
1986      201        NA    NA  37.3  (75)   4.0   (8)   2.0   (4)   0.0   (0)
1987      115        NA    NA  38.3  (44)   1.7   (2)   0.0   (0)   0.0   (0)
1988      117        NA    NA  31.6  (37)   4.3   (5)   0.0   (0)   0.0   (0)
1989      107        NA    NA  59.8  (64)   2.8   (3)   0.9   (1)   0.9   (1)
1990      179        NA    NA  76.5 (137)   6.7  (12)   1.7   (3)   1.1   (2)
1991      128        NA    NA  83.6 (107)  14.1  (18)   2.3   (3)   0.8   (1)


Part 1 of 1 Press Enter to continue, P to print, arrow and page keys to
browse:
```

Minimum species stock and quality lengths used by FISHTAB in calculating Proportional Stock Density (PSD).

Stock and quality sizes (in centimeters) for 23 fish species are presently encoded in FISHTAB. These are used automatically whenever these species are analyzed by the Stock Index and General Output modules. For any species not listed below, FISHTAB requires the user to enter these lengths when running the Stock Index and General Output modules. Stock and quality sizes are taken from Gabelhouse (1984).

Species code	Stock size		Quality size	
	cm	in	cm	in
BGB	28	11	41	16
BLB	15	6	23	9
BLC	13	5	20	8
BLG	8	3	15	6
CAP	28	11	41	16
CCF	28	11	41	16
FCF	28	11	41	16
FRD	20	8	30	12
GSF	8	3	15	6
GZS	18	7	28	11
LMB	20	8	30	12
NOP	35	14	53	21
RSF	10	4	18	7
SAR	20	8	30	12
SBH	20	8	30	12
SMB	18	7	28	11
STB	30	12	51	20
WAE	25	10	38	15
WHB	15	6	23	9
WHC	13	5	20	8
YEB	13	5	20	8
YEP	13	5	20	8
YLB	10	4	18	7

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APPENDIX A - Procedure for backing up Paradox data files

(a soliloquy by Dan Gavrilovic)

You're done! You've worked long and hard and finally all your precious data is safely tucked away into that cozy Paradox file on your PC's hard drive, ready to cough up all the mysteries of the deep at your beck and call. Time to turn off the lights and call it a day. NOT SO FAST PAL! What if your hard drive kicks the tackle box while you're gone? Contrary to popular belief, hard drives are not immortal and the one you just entrusted with your priceless data may be on it's last spin cycle (ahem, especially if it happens to be one of the old 286 hand-me-downs you recently got from Springfield). When it goes, your data goes with it. Think about it. Picture yourself pecking away at the keyboard all over again, squinting at the hopeless scribbles on your data sheets hour after hour after hour while all your buddies are out shoot'n turkeys. And worst of all, you'd know it's your own damn fault! And even worse, so would everyone else. You knew all along you should have backed that data up. It would have only taken a couple of extra minutes to do it. Don't know how to go about it you say? Well, here's a simple way that works well with Paradox files. Proceed as follows:

Prelude. You're running Paradox and you're in the directory where the file you want to back up resides. You have a formatted diskette inserted in your A (or B - your choice) drive. This diskette has enough room on it to receive the file you want to back up. The stage is set. The tension is high. The backup drama is about to unfold.

Act 1. Click once with the left mouse button on the *Tools* menu item in the Paradox menu bar at the top of the screen. You don't have a mouse? No problem. Press the <**F10**> key (at the top of your keyboard) to gain keyboard access to the menu bar and than press <**T**>. Either upper or lower case letter works.

Act 2. You notice that when you clicked on the *Tools* menu item, a drop down menu appeared. Click on the *Copy* menu item in that drop down menu or, if you prefer the keyboard, press <**C**>. You'll see another drop down menu appear.

Act 3. Click on *Table* menu item in this latest drop down menu. A window opens up. Click on OK or press the <**Enter**> key to fill this window with names of all the files that reside in your current directory. Click on the file you want to back up and than click on OK or use the cursor keys to move the green selector box to the desired file and than press <**Enter**>. You'll notice another window open.

Act 4. This new window has a blue box in it. There is a blinking cursor in the blue box. You are being prompted for the location and name of your soon to be backup file. You need a break!

Interlude. While you're getting a cup of coffee, you need to decide how you want to name your backup file. Since it will be saved on a floppy disk it really doesn't matter whether you retain the original name or change it to something that will let you know this is a backup file. Just be sure to comply with the DOS naming convention which limits file names to eight characters.

Final act. Type the following in the blue box: drive name, followed by a colon, followed by the file name you've chosen. Press <**Enter**> (A:BASSDTA2 <**Enter**> for example). You're done!

APPENDIX B - Merging Paradox tables

Suppose you want to add data from one Paradox table to another Paradox table. You may, for example, want to add your current annual sampling data to your historic sampling data. This is how you'd go about accomplishing this task.

Before you can add data from one table to another, you should be aware of one caveat. The two tables involved in the adding process, the source table and the target table, must have compatible, though not necessarily identical, field types in the same order. What this means is that any kind of numeric field can only be added to another numeric field, an alphanumeric field can only be added to another alphanumeric field and a date field can only be added to another date field. If the structure of the two tables you're dealing with is identical, as is the case with current annual and historical sampling data tables being used in this example, then the requirements of the above caveat have already been met. With your historic data table being the target table and your current annual data table being the source table, proceed as follows:

1. Click once with the left mouse button on the *Tools* menu item in the Paradox menu bar at the top of the screen. If you'd rather use a keyboard, press the <**F10**> key to gain keyboard access to the menu bar and than press <**T**>. Either upper or lower case letter works.

2. You notice that when you clicked on the *Tools* menu item, a drop down menu appeared. Click on the *More* menu item in that drop down menu or, if you prefer the keyboard, press <**M**>. You'll see another drop down menu appear.

3. Click on *Add* menu item in this latest drop down menu. A window opens up. Click on OK or press the <**Enter**> key to fill this window with names of all the tables that reside in your current directory. Click on the table you want as your source table, annual sampling data in this example, and than click on OK or, if you prefer the keyboard, use the cursor keys to move the green selector box to the desired file and than press <**Enter**>. You'll notice another window open.

4. Again, click on OK or press the <**Enter**> key to view the tables in your current directory. Select the table you want as the destination table for your current annual sampling data, in this case your historic sampling data table, and press <**Enter**>.

5. The window will disappear and if you look at your destination table, you'll notice that all the records from your source table have been added to the bottom of the existing records. The source table remains unchanged.

Note that in the case of applying this procedure to your current annual and historic sampling data tables, you'd have to repeat the procedure five times, once each for tables screen_4 - screen_8. Also note that a more detailed discussion of the *Tools* | *More* | *Add* feature of Paradox can be found on page 622 of Borland Paradox for DOS - User's Guide.

APPENDIX C - Updating the Paradox Water95 table.

In order to enter data for a given lake into the FAS database, that lake has to exist in the Water95 table. The current version of this table has over 4,000 records which means that more often than not, you'll be able to find the lake you need here. There may be a time, however, that the lake you're working with is not in this table. The following procedure describes how to add a new lake to the Paradox Water95 table.

1. In order to make changes to any Paradox table, you first need to enter the edit mode. You do this via the *Modify* | *Edit* menu sequence, ie., you click once with the left mouse button on the *Modify* menu item in the horizontal menu bar at the top of the Paradox desktop and than click on the *Edit* menu item in the resulting drop down menu. An empty, "closed", window appears. This window can be used to "look" at the contents of any directory on your PC by simply typing in the path to that directory in the blue box with the flashing cursor and clicking on the OK button or pressing the <**Enter**> key. To "open" this window on the directory you're currently working in, you simply click on the OK button or press the <**Enter**> key. Once the window "opens" and you can see all the tables in your current directory, you need to select the desired table, Water95 in this case, by clicking on it with the mouse and than clicking on the OK button. If you prefer keyboard input, you can accomplish the same task by using the cursor keys to move the green selector box to the desired table and than pressing <**Enter**>. The selected table will open on your screen and you will be in Paradox edit mode, as evidenced by the change in the horizontal menu bar at the top of the screen.

2. In order to insert a new record into the table, press the <**Insert**> key. A blank new row appears above the cursor location. Type in the desired information for the new lake. Repeat this procedure if more than one lake is to be added to the table.

3. Once you've finished editing the table, click on the *DO-IT!* menu item at the top of the screen, or press the <**F2**> key. This saves the changes you've made to the table and takes you out of the edit mode.